Master's Thesis

Identification of Country-Specific Factors Influencing the «Service Quality» and the «Access to Data» of International Public Procurement Infrastructures from an Outside Perspective

A first attempt

submitted to

Faculty of Business, Economics and Social Sciences

at the University of Bern

Institute of Information Systems

Information Engineering/Information Management

Dr. Matthias Stürmer

submitted by

Tobias Bärtschi

of Eggiwil, BE

in the 6. Semester

Matriculation Number: 06-727-598

Address

Sägefeldstrasse 1

4563 Gerlafingen

076 405 55 49

tobias_baertschi@bluewin.ch

Bern, 19.04.2020

Abstract

According to the OECD, its member states devote substantial expenditures on national and international public procurement, averaging around 13% of their GDP. This is financed with public funds, and has always been susceptible to corruption and mismanagement. In the course of digitalisation, many countries have set up electronic procurement portals to make procurement processes more transparent and promote competition among suppliers. However, the quality and services offered vary greatly. This work aims at identifying factors that differ between countries providing varying quality levels of e-procurement infrastructure. In a first step, the procurement portals of 207 countries and territories were surveyed and evaluated regarding "Service Quality" and "Data Access". In a second step, country-specific factors were selected and their influence on the collected procurement portal data was examined. The data suggest the factors degree of democratization and country size have the greatest influence on the procurement infrastructure.

Zusammenfassung

Die Ausgaben für nationale und internationale öffentliche Beschaffung sind laut OECD mit rund 13% des BIP der Mitgliedsstaaten erheblich. Diese werden mit Steuergeldern finanziert und sind seit jeher anfällig für Korruption und Misswirtschaft. Um die Beschaffungsprozesse transparenter zu gestalten und die Konkurrenz unter den Anbietern zu fördern, haben viele Länder im Zuge der Digitalisierung elektronische Beschaffungsportale eingerichtet. Die Qualität und die angebotenen Dienstleistungen variieren jedoch stark. Ziel dieser Arbeit ist es, Faktoren zu identifizieren, die sich zwischen Länder unterscheiden, die unterschiedliche Qualitätsniveaus an elektronischer Beschaffungsinfrastruktur bereitstellen. Dazu wurden in einem ersten Schritt die Beschaffungsportale von 207 Ländern und Gebieten erfasst und hinsichtlich «Service Qualität» und «Daten Zugang» bewertet. In einem zweiten Schritt wurden länderspezifische Faktoren ausgewählt und deren Einfluss auf die erhobenen Beschaffungsportaldaten untersucht. Die Daten legen nahe, dass die Faktoren Demokratisierungsgrad und Landesgrösse den stärksten Einfluss auf die bereitgestellte Beschaffungsinfrastruktur haben.

Table of Contents

1 Introduction

1.1 Context

In the early 19th century, trade and international relations among nations began to increase. The mostly closed and locally oriented economies of that time changed to a more open, world-oriented behaviour. This was driven increasingly by world events and less and less by local factors. Over the years, those developments intensified, accelerated and are ongoing to this date. Today this phenomenon is known as Globalization (O'Rourke & Williamson, 2002, pp. 46-47; 2004, p. 115). In our connected, globalized world, domestic and international trade as well as interconnectivity are increasing. According to the Trade Policy Review Body of the World Trade Organisation (WTO) (2018, p. 10), the global trade growth in 2017 was significantly stronger than in 2016, following a stagnation phase in 2014/2015. The volume of the world merchandising exports increased by 10.6% to US$17.73 trillion and commercial services exports grew by 7.4% to US$5.25 trillion. The combined gross national product of all the countries in the world rose on average 3.1% in 2016 and 3.5% in 2017.[1] Government administrations on behalf of their countries, public organisations and supranational organizations have to participate in the growing global market too. This expenditure of public funds to purchase goods, services and construction works to fulfil their respective duties is commonly referred to as public procurement (Lloyd & McCue, 2004, pp. 22-25; Mankiw & Taylor, 2011, pp. 222-226).

Unfortunately, there are no absolute numbers on global public procurement spending. To complicate matters more, there are two different data concepts for analysing public procurement, the macro and micro level approach. Regarding government spending of countries, the volume of public procurement is recorded as percentage of the annual gross domestic product (GDP). The situation is aggravated by the fact that not all countries provide eligible numbers or transparent data concerning their public procurement (Kutlina-Dimitrova, 2018, pp. 3-8).

The annual spending for general public procurement by Organisation for Economic Co-operation and Development (OECD) members as a percentage of their respective GDP ranges from 20.18% in the Netherlands to 5.15% in Mexico in 2015.

---

[1] See IMF statistics, available at: https://www.imf.org, web access 18. November 2019.

Switzerland is with 8.76% at the lower end of the spectrum, just behind the USA with 9.35% of the GDP. The OECD average was 13.18% in 2015 and remains fairly constant.[2] This data suggests that the absolute amount of public spending is growing over the years simultaneously alongside the GDP.

Public procurement is significant for national and international trade, principles of law and free trade and impacts how taxpayers' money is spent. Therefore, countries have established rules for public procuration to prevent discrimination of offerors. In addition to state law, rules regarding transparency and fair public procurement are also an important part of many international trade agreements and legal frameworks (Nielsen, 2005, pp. 9-13). Nevertheless, in government procurement a preference for national companies can be observed. This means governments tend to favour local providers for the procurement of goods and services (Cernat & Kutlina-Dimitrova, 2015, p. 2; Rickard & Kono, 2014, p. 347). It's not always transparent how and why certain contracts have been awarded; the established rules and regulations serve to increase transparency. The OECD for example, lists measures to increase transparency in public procurement in the first Chapter of its publication "OECD Principles for Integrity in Public Procurement" (Elodie & Organisation for Economic Co-operation and Development, 2009).

Before the internet and related technologies, the public tendering process was mainly based on paper and telephone (Gebauer, Beam, & Segev, 1998, p. 167). Since then various measures for strengthening the efficiency of public procurement have been implemented. In recent days, interested parties and potential offerors can ideally visit a public web portal and access all the relevant information they need to make an offer. The bidding and contracting data are publicly available as well (Saussier & Tirole, 2015, pp. 7-13). Those opportunities and measures, also known as e-procurement, provide an unprecedented level of information transparency and ease of access in public procurement.
Today, national law and international agreements govern public tendering and procurement procedures. To gain the benefits of e-procurement mentioned before,

---

[2] See OECD statistics, available at: http://stats.oecd.org, web access 18. November 2019.

many countries and organization set up their web portals to improve accessibility and provide information transparency.

1.2 Research setting

As it has been shown, more transparency leads to more competition; but more competition can only occur if more potential offerors have access to the tender. Globally, there are a great number of e-tendering web portals of different organisations and their suborganisations, as well as portals of individual countries. Many countries have portals on various levels (e.g. state level, municipality level, etc.). With the large number of portals and many of them on a local level (e.g. in the EU), it's difficult to keep track and gain a consistent overview over open tenders. Additionally, the portals often provide different levels of information and functionalities, as well as different data formats (exchange formats), ways to provide data to the public and types of application programming interfaces (API) to access the data. In short, there is no common standard.

For example, in 2002 Mr. Philippe Lebaube (2002), Head of Unit at the Office for Official Publications of the European Commission, stated in an interview that the "lack of agreed European standards for exchanging information related to e-procurement" is a main obstacle. Until 2009 the EU ran several programmes to develop such standards.[3] In its 2017 published report on certification of e-tendering platforms the EU sets merely guidelines for a future certification process. Electronic procuration became mandatory for all contracting authorities in all EU member states as of October 2018 (EXEP Subgroup Certification, 2017, pp. 3-11). This illustrates the challenges in setting up uniform standards for such web portals already on EU level. Globally seen, those problems are even much more complex.

Not only the lack of standards poses a problem, the dynamic nature of the global e-procurement landscape is complicating the whole situation additionally. New portals open, old portals are getting closed or left abandoned, and the tender publications shift from one site to another. These dynamics make data gathering and keeping track of the portals very challenging. The effects of these dynamics can also

---

[3] See European Commission > IDABC > eProcurement, available at:

http://ec.europa.eu/idabc/en/document/2084/5874.html, web access 18. November 2019.

be observed while browsing through already existing e-procurement portal databases. Most prominent in this field is the research done by The World Bank.[4] Every year, starting in 2015, the World Bank releases its "Procuring Infrastructure Public-Private Partnerships (PPPs)" report. This report is based on a survey. The responsible government agencies of the respective countries answer the questions themselves and send them back to the World Bank for the data evaluation. Unfortunately, not all countries are present in the Word Bank's database. Some of the data is missing also for the included countries, and some of the data is outdated or simply incorrect.

Similar problems can be observed for the procurement dataset of the Global Open Data Index.[5] Here the data is gathered by crowdsourcing based on a unified scoring framework. Unfortunately, the last update has been made in 2016/2017, which leads to an outdated and faulty database. Furthermore, not all countries are included in this database either.

Another, but a not insignificant problem is the language barrier. Many e-procurement portals and related publications are only providing the respective national language or lack the support of English on the site. As reported in a study from the European Commission (RAMBOLL/HTW Huhr, 2011, pp. 79-80), language barriers are perceived by participating businesses as the most prominent obstacle in cross-border procurement. Likewise, the language barriers constitute not only a problem for potential offerors, but also for the monitoring and evaluation of the respective e-procurement portals.

The mentioned difficulties and further minor issues lead to a rather difficult research setting with regards to a study with a global focus.

---

[4] See the World Banks "Procuring Infrastructure Public-Private Partnerships" database, available at: https://bpp.worldbank.org/, web access 7. December 2019. Additionally, see the World Banks "e-Procurement World Map", available at: https://wbnpf.procurementinet.org/featured/e-procurement-world-map, web access 7. December 2019.

[5] See the Global Open Data Index' Procurement Dataset, available at: https://index.okfn.org/dataset/procurement/, web access 7. December 2019.

1.3 Research questions

As stated, this topic is certainly very complex, and a comprehensive analysis cannot be accomplished in the context of a master's thesis. Nevertheless, this work shall provide a solid approach to the topic. An analysis of the current situation regarding e-procurement portals, together with an analysis of the drivers behind increased service quality and data accessibility of the e-procurement infrastructure on a country level is sought. It shall provide insights into which variables further an improvement of said characteristics. These insights ultimately can be used to identify favourable moderating factors once mandatory standards will be set.

To gain these intended insights, the following five research questions were investigated:

1) How does the e-procurement infrastructure look like on each country level?
2) What is the service quality level in each country?
3) How does the level of access to data for each country look like?
4) Which factors distinguish countries with a higher level of service quality from those with a lower level?
5) Which factors distinguish countries with a higher level of access to data from those with a lower level?

1.4 Objectives

To answer each of these questions, the following objectives must be reached.

How does the e-procurement infrastructure look like on each country level?
First, a database containing the necessary data regarding e-procurement portals on a country level must be created. For this (purpose) it is necessary to grasp the current situation regarding the e-procurement infrastructure in each country. This will be done by manually gathering and entering? the data necessary for later evaluation. It shall be answered whether there is an up-to-date e-procurement infrastructure existing or not, and whether there is one unified portal for each individual country or not.

What is the service quality level in each country?

Once these data have been gathered, an evaluation framework suited to determine the level of "Service Quality" of each of the found e-procurement infrastructures shall be developed. The infrastructures found for each country shall then be evaluated by using the developed framework to rank the countries according to their service quality.

How does the level of access to data for each country look like?

Like for the previous question, an evaluation framework suited to determine the level of "Access to Data" of each of the e-procurement infrastructures shall also be developed. Again, by applying this evaluation framework the infrastructures found for each country shall then be evaluated and ranked according to the offered data access.

Which factors distinguish countries with a higher level of service quality from those with a lower level?

And

Which factors distinguish countries with a higher level of access to data from those with a lower level?

A set of potential factors serving as independent variables shall then be defined. The data shall be described and analysed by using suitable statistical methods to examine the dependencies between the determined factors and the data. This shall allow drawing the conclusion which factors have the biggest influence on either service quality or access to data.

1.5 Research methodology

The following methods or a combination of these will be used to answer the raised questions and fulfil the set objectives in this work.

1.5.1 Data collection

The data collection is done manually. For each country a reasonable amount of time is spent to identify the relevant portal(s) and to gather the needed data. This translates

to an average of around three hours spent for each country, ranging from a minimum of 30 minutes up to a maximum of 12 hours. Great care will be taken to grant every country a fair treatment even in complicated circumstances (e.g. language barriers).

1.5.2   Literature analysis

An analysis of the current literature is especially eminent for the following two occasions in this work:

Development of the assessment frameworks

Based from Yang, Shaoha, Zhen and Zhous' (2005) work on service quality regarding information presentation on web portals, an assessment framework shall be developed. To achieve this, the relevant literature shall be analysed to identify criteria suited to assess the found platforms with regards to service quality.

The second framework to assess the platforms with regards to access to data will be based on the Open Contracting Data Standard.[6]

Identification of the factor candidates

To identify suitable factor candidates, again the relevant literature shall be analysed. To limit the scope of this work, the number of factors to be tested has been set to nine for "Service Quality" and to ten for "Data Access" respectively (with "Service Quality" being the additional factor in "Data Access").

1.5.3   Rating

The developed frameworks shall be applied to the data gathered. The e-procurement infrastructure shall be ranked based on a "Service Quality" and "Data Access" level.

1.5.4   Statistical evaluation

The data set composed during this thesis shall get examined with basic descriptive statistical methods. To determine the factors most influencing the service quality and access to data, a suitable regression model shall be found and applied.

---

[6] See Open Contracting Data Standard: Documentation, available at: https://standard.open-contracting.org/latest/en/, web access 8. December 2019.

1.6 Thesis structure

This work will be structured as follows:

- Terms and Definitions
- Framework Development
- Data
- Statistical Analysis and Results
- Conclusions

Terms and definitions

The chapter "Introduction" takes a broader perspective on the thesis, methods and context. In the chapter "Terms and Definitions" the perspective will be narrowed down and focused. A short overview of what procurement and e-procurement means, how a portal works and which parts it should provide shall be given. Moreover, the terms "Service Quality" and "Access to Data" shall be defined and elucidated. A short declaration about the used geographical terms will complete this chapter.

Framework development

Both frameworks to assess the infrastructure-data shall be developed in this chapter. By using the methods of the literature analysis, the appropriate criteria shall be found to adapt Yang, Shaoha, Zhen and Zhous' (2005) work to assess e-procurement infrastructures regarding their service quality.

Additionally, the framework to assess access to data shall be developed based on the Open Contracting Data Standard.

Data

The chapter "Data" contains two main parts. The first part will focus on the e-procurement infrastructure data gathered for this work. It will show how the data have been gathered, how the framework is applied and what the result of the ranking looks like. It is important to determine the nature of the data before choosing a suitable regression method. This will also be done in this chapter.

In the second part, a set of potential factor candidates serving as independent variables in the regression analysis shall be identified. This will be done based on a literature analysis.

Statistical analysis and results

Based on the observations from the chapter "Data", a suitable regression method will be determined. All relevant calculations will be performed and explained for both data sets ("Service Quality" and "Data Access").

Finally, the results will be presented together with a discussion of possible methodical problems.

Conclusions

In this last chapter, the findings will be discussed, and possible conclusions will be drawn. Emerging limitations and problems shall be discussed, and suggestions for improvement? shall be made. Additionally, a summary of the work will be presented together with an outlook on possible future developments. Furthermore, recommendations for further research will be given.

1.7 Practical and scientific relevance

As stated above, this work shall provide a first attempt to catalogue the global e-procurement portals, and to help identifying factors favouring a positive development towards better e-procurement infrastructures and better access to data. The increase in transparency and open access provided by web-based public tendering portals affects many aspects of public procurement in an advantageous manner.

Scientific research

The benefit a well-functioning e-procurement system can provide for governments and subsequently societies around the globe are undisputed and well researched. Much has been done in case studies focusing on a single area or a single country only. (e.g. Podkolzina, Pivovarova & Balsevich, 2011; Waruguru, 2015; Ribeiro, Vaz & Matheus, 2011). Additionally, factors determining what makes an e-procurement system useful (Dooley & Purchase, 2006) and factors affecting its

software (Saxena & Agarwal, 2018) have been identified. Research has also been done on factors that affect e-procurement implementation (Patel, Satrndrakumar & Khajuria, 2016 and Vaidya, Sajeev & Callender, 2006), but based on literature reviews and not on a global scale. These examples show that attempts to identify factors influencing e-procurement implementation have been made, but more on a theoretical level, than researching the current global situation as a whole.

A lot of research has already been done. But the approach to identify factors characterizing countries, that already provide e-procurement portals with a qualitatively more advanced infrastructure and a better access to data than others, could not be found. This is surprising as it is known that the quality of a system or an infrastructure is influencing the intention to use and through that the use itself (see figure 1; Delone & McLean, 2003; Mardiana, Tjakraatmadja & Aprianingsih, 2015, p. 358).
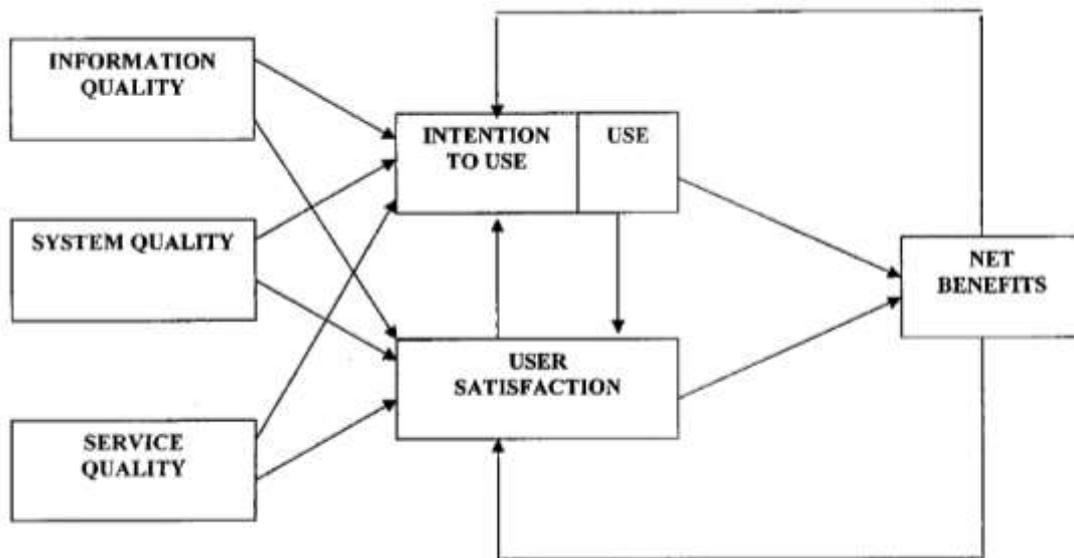
Figure 1: DeLone and McLean (2003, p. 24) updated IS success model.

This seems especially important with regards to procurement, where more users or offerors lead to lower procurement prices. With that knowledge, an attempt to identify the country-specific factors favouring the implementation of e-procurement systems of higher quality can be rewarding.

Similar, Podkolzina, Pivovarova and Balsevich, (2011, pp. 7-11) confirm that increased information transparency negatively affects the level of corruption and leads to more competition as illustrated in figure 2.
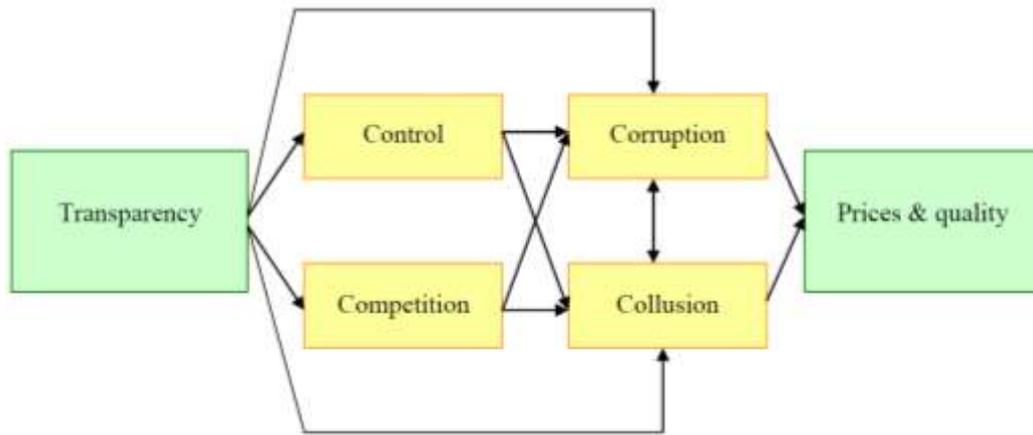
Figure 2: Summary of the possible channels of interrelationship between transparency and the results on procurement by Podkolzina, Pivovarova and Balsevich (2011, p. 6).

Information transparency increases the utilization of control mechanisms and attracts more opportunistic suppliers, and therefore lowers the thread of potential collusion. Subsequently "improving transparency will help reduce costs, which in turn will lower prices and enhance national welfare" (Evenett & Hoekman, 2005, p. 178).

Practical application

In practice more towards investigating country-specific factors with regards to procurement has been done. Two attempts to record and grasp the situation more globally have been identified. The World Banks "Procuring Infrastructure Public-Private Partnerships (PPPs)" report and the procurement dataset of the Global Open Data Index have already been mentioned, and their respective problems have been set out in the chapter "1.2 Research setting" of this thesis.

The World Bank released in its PPPs 2018 report (p. 14) an analysis based on the data gathered via the aforementioned survey. Thereby, they were taking a wider approach. The survey examines the procurement process as a whole, namely the categories of preparation, procurement, unsolicited proposals and contract management. Unfortunately, the quality of the actual infrastructure and the portals themselves were only marginally addressed. Especially the "how" data is provided is only marginally investigated. Quality classifications are purely based on the income groups of the respective country and show only the average scores for each category.

The Global Open Data Index[7] pursues as different goal. Here the review of the procurement infrastructure of a country is a minor part of the index. The focus is strongly on how the data is provided and how accessible the portal is. The promotion of open standards and free access to data is a priority. In contrast, the World Banks approach appears to provide a tool for managerial and geopolitical decisions. Nevertheless, both publications are highly relevant for practical applications.

Conclusions

This work shall be a first step to structure and grasp the international public procurement landscape and can serve as a base for the comparability of infrastructures over time, the promotion of openness and future research.

Challenges such the lack of standardisation, language barriers and confusion regarding the mass and complex interconnectivity of such portals, must be overcome in the future. Therefore, the development of an index of international public e-procurement portals is highly relevant.

Such an index together with the knowledge about country-specific factors influencing the adaption of e-procurement services can be used to identify weaknesses and opportunities. This could help to implement e-procurement infrastructures with a higher quality and better access to procurement data.

Ultimately, this can lead to lower prices, help to fight corruption and will subsequently benefit the population of the respective nations.

---

[7] See the Global Open Data Index, available at: https://index.okfn.org/, web access 28. December 2019.

2 Terms and definitions

2.1 What is public procurement

The topic of public procurement is rather complex. Therefore, this part will provide the necessary information with regards to the focus of this work and a limited overview over the whole subject matter.

2.1.1 Defining public procurement

2.1.1.1 Public goods

It is part of a government's mandate to provide certain goods to its citizens. These goods are non-rival and non-excludable. This means that one person's consumption does not decrease the quantity or affect the quality of the good available to others. Additionally, it is often not possible to prevent individuals from freely consuming a public good. Goods of that nature are called public goods. Examples are national defence, basic research or fighting poverty. However, governments cannot produce all the inputs for the goods they provide themselves. Therefore, for government's procurement of those inputs is a necessity to fulfil their respective duties. Due to the non-excludable nature of public goods and the benefit all citizens will receive from them, this procurement is financed by taxpayer money (Mankiw & Taylor, 2011, pp. 222-226).

2.1.1.2 Regulatory principles and the danger of corruption

According to the OECD (2016, pp. 6-7) public procurement is one of the government activities most vulnerable to corruption. Many procurement processes are very complex in nature and involve high amounts of government funds or taxpayer money. This is exacerbated by the close interaction between public officials and businesses, and the multitude of stakeholders. For governments, that vulnerability to corruption carries the risks of losing public funds through misallocations, higher expenses as well as lower quality of goods, services and works. Additionally, corruption can distort competition, limit market access and reduce business appetite

for foreign investors. This not only harms the local market, but also has global effects.

These problems lead to a strong regulation of public procurement, both on a local governmental level and on a superordinate level (for examples through trade and framework agreements). Modern legislation is or at least should be based on four principles (Maciejewski & Ratcliff, 2019; Konkurrensverket[8], 2018; OECD, 2016, pp. 10-28).

- **Efficiency/Proportionality**
- **Equal treatment of providers**
- **Competition**
- **Transparency**

Efficiency/Proportionality is a main goal of the procurement process. The procurement effort should be proportional to the object or financial turnover expected for a certain transaction (Konkurrensverket, 2018).

Non-discrimination/Equal treatment of providers means that no provider is discriminated based on its nationality or the location of its establishment or operations. This also applies if the procurement authority does not expect tenders of foreign nationalities.

Furthermore, all providers must be subject to the same conditions. Meaning, the same access to information shall be granted for all suppliers at the same time. All candidates shall be threatened the same way and the same rules must apply to all of them (Konkurrensverket, 2018).

Competition must be encouraged to ensure that the procurement authorities can obtain products and services of the highest available quality at the best price. In

---

[8] The Swedish procurement legislation is seen as a modern example. Heavily based on the mentioned principles, Sweden dispenses a local e-procurement portal and publishes all invitation to tender on the portal of the European Union TED (Tenders Electronic Daily).

The fifth principle the Swedish competition authority list, the principle of mutual recognition, is certainly important specifically with regards to a confederation of countries like the EU. Nevertheless, with regards to the focus of this work, it is only of minor significance. Therefore, it is not in the list of the four core principles listed in this work.

addition to directly benefiting the procurement authority, this principle increases the competitiveness of the companies locally and also with regards to competing globally (Maciejewski & Ratcliff, 2019).

Transparency is one of the key principles for good governance in the public sector and marks an important anti-corruption mechanism. It allows all involved parties and the public to maintain an overview and monitor the procurements and the ongoing processes. This means all the procurement rules are known in advance, information relating to the procurement may not kept secret and every decision made is documented and comprehensible. The procurement authority must balance the need for publishing the information required with the need for confidentiality of the procedure as well as of the received offers. The information published must at least include the specifics about upcoming contracts, contract notices and the status of ongoing procurement processes. Additional information may further help external parties to review the government's public procurement practice (Konkurrensverket, 2018; OECD, 2016, pp. 15-17).

A major tool to increase transparency in the course of public procurement is the implementation of an e-procurement infrastructure. This makes the documentation and access to relevant information much easier (OECD, 2016, p. 22).

2.1.1.3   Legal definition of public procurement

It is not surprising, that public procurement is globally seen one of the most legislated and regulated government activities (Lloyd & McCue, 2004, p. 2.). With that in mind, legal definitions and procurement legislation cannot be ignored, while determining what exactly "public procurement" means. Even though this work has a global perspective, it is not feasible to inspect every country's procurement laws individually. An overview of the United States (U.S.) Government Procurement Act and the EU regulatory framework for procurement must suffice. Globally, these two regulatory frameworks are very influential and will serve as examples for countries specific regulations.

The regulations of the United States of America (USA) are very specific with their definition for the term "public procurement" as written in 41 U.S. Code § 111[9]:

> "The term 'procurement' includes all stages of the process of acquiring property or services, beginning with the process for determining a need for property or services and ending with contract completion and closeout."

The EU does not provide a direct definition. However, directive 2014/24/EU[10] on public procurement is more detailed on what "public procurement" means by focusing more on the contracts and contracting procedures itself:

> "Article 1
>
> 1. This Directive establishes rules on the procedures for procurement by contracting authorities with respect to public contracts as well as design contests, whose value is estimated to be not less than the thresholds laid down in Article 4.
>
> […]
>
> Article 2
>
> […]
>
> (5) 'public contracts' means contracts for pecuniary interest concluded in writing between one or more economic operators and one or more contracting authorities and having as their object the execution of works, the supply of products or the provision of services;
>
> […]"

---

[9] 41 U.S. Code § 111. Procurement, seen on: www.law.cornell.edu/uscode/text/41/111, web access: 8. January 2020.

[10] DIRECTIVE 2014/24/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 26 February 2014 on public procurement and repealing Directive 2004/18/EC, seen on: https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1415180510261&uri=CELEX:32014L0024, web access: 8. January 2020.

Both legal frameworks are looking at public procurement as a process. The U.S. specifically outlines the process with a start ("process for determining a need for property or services") and an end point ("contract completion and closeout"). The EU regulations include everything concerning "procedures for procurement by contracting authorities with respect to public contracts".
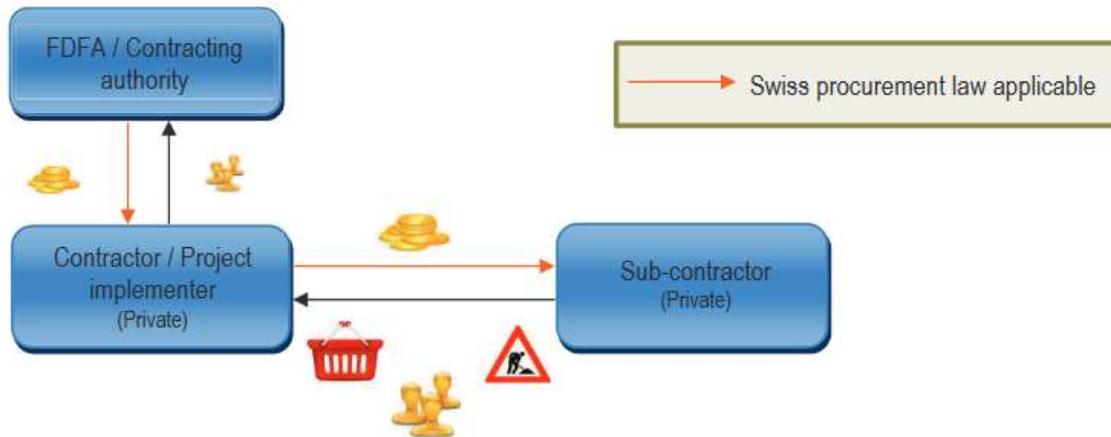
Figure 3: Scope of public procurement regulations. Here using Switzerland as an example (FDFA, 2016, p. 2).

In general, procurement law regulates the relationship between the contracting authority and the private contractor respective sub-contractors. As an example, the Swiss procurement law is applicable between contracting authority and the private contractor (winner of the procurement) as well as between the contractor and a possible sub-contractor (see figure 3).

2.1.1.4   Summary

The term "public procurement" is broader than the government's spending of public funds to purchase goods, services and construction works. In fact, it is debated which activities "public procurement" includes and to what extent it can be defined (Lloyd & McCue, 2004, pp. 24-25). For the scope of this work, a precise determination is not needed, and as it is controversial anyway, the following definition derived from the overview provided in this chapter is considered sufficient.

Public procurement means every procedure involved in procurement by contracting authorities with respect to public contracts, starting with the process of determining a need for property or service, and ending with contract

completion and closeout, under the principles of efficiency/proportionality, equal treatment of providers, competition and transparency.

It is implied, that the publication and provision of public procurement data is included in that definition through the principle of transparency. An exact demarcation of modern public procurement activities and open government activities concerning data aspects, cannot easily been done as these areas overlap strongly.

2.1.2   The procurement process

In the previous chapter it has been established, how public procurement is regulated. Consequently, the procurement process itself is also prescribed by a country's law.

Generally, the procurement process can be divided into three phases. During the initial "pre-tendering phase" a suitable procedure for the procurement in question is chosen. During the tendering phase, the goods or services are procured according to the rules of the chosen procedure. The tendering phase ends with the contract award. In the post-award phase, the contracts are managed, and the performance of the awarded suppliers should be monitored. Subsequently the order and the payment are made according to the contract (see figure 4; OECD, 2016, p. 9).

Pre-tendering phase
- Needs assessment and market analysis
- Planning and budgeting
- Development of specifications/requirements
- Choice of procurement procedure

Tendering phase
- Request for proposal/bid
- Bid submission
- Bid evaluation
- Contract award

Post-award phase
- Contract management/performance
- Order and payment
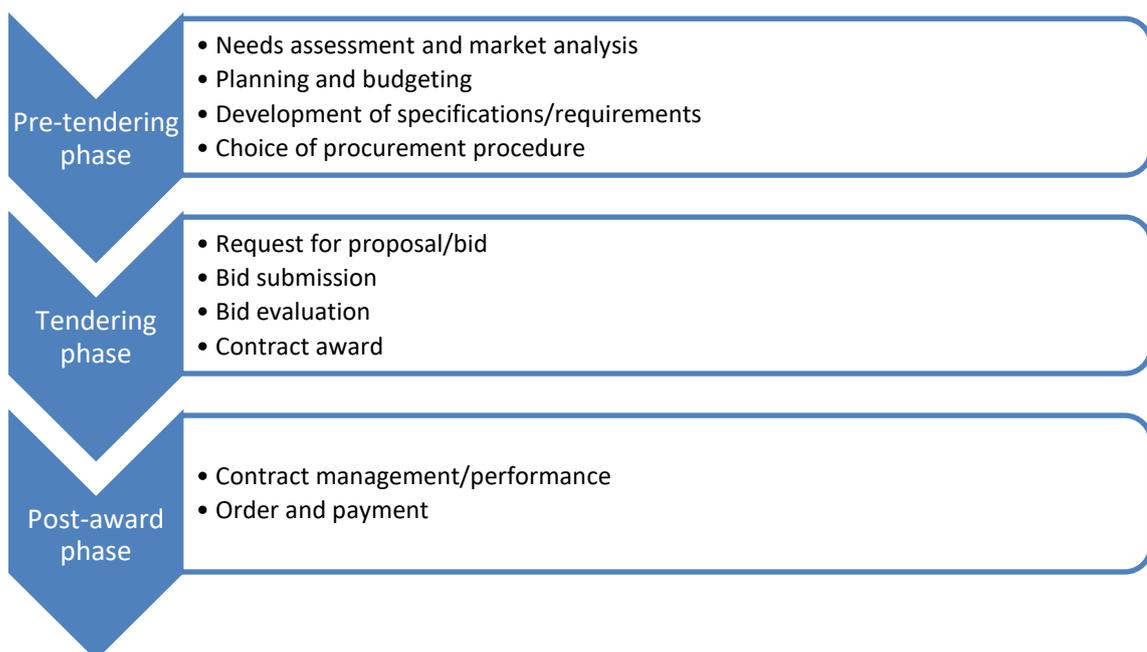
Figure 4: Overview of a procurement process in general (OECD, 2016, p. 9).

Public procurement is subject to efficiency and proportionality. This means the procurement procedure, chosen during the pre-tendering phase, must be proportional to the object of the procurement (Konkurrensverket, 2018). As an example, the purchase of printer paper does not require the same effort as building a motorway.

2.1.2.1   Thresholds and the choice of procedure

The choice of a procurement procedure depends on the estimated contract volume of a project and the nature of the objects or service to be purchased. Legally defined thresholds determine the scope of the procedure (Maciejewski & Ratcliff, 2019, p. 3). This or a comparable system can be found in the procurement legislation of the majority of the countries examined for this work. However, the height of these thresholds can differ considerably from country to country. For visualization purposes, the following figure shows the procurement threshold system of Switzerland.
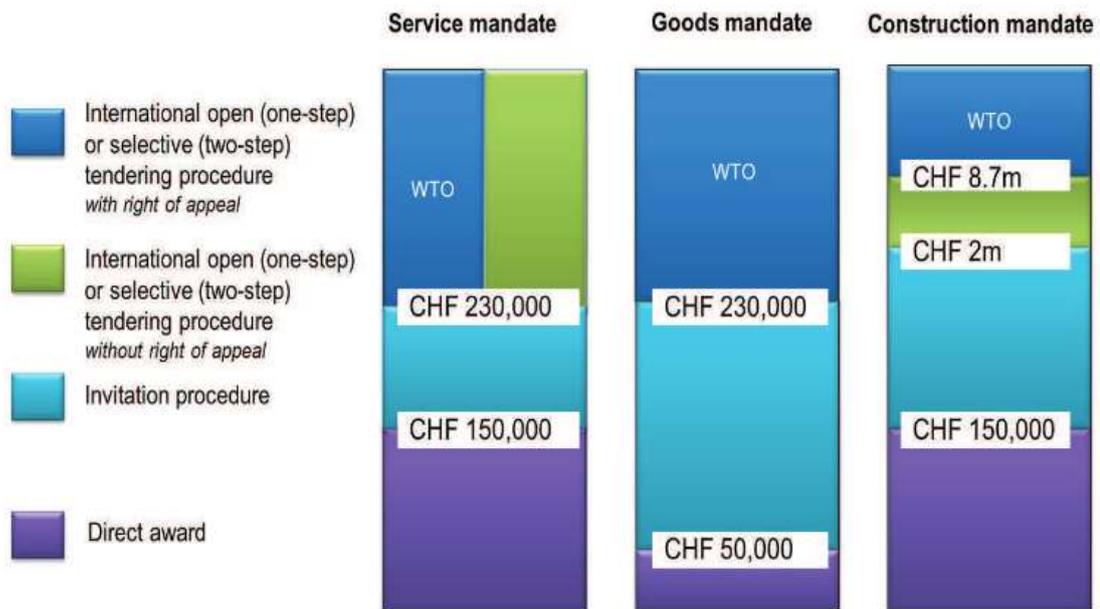
Figure 5: System of procurement thresholds of Switzerland (FDFA, 2016, p. 5).

The height of the different thresholds determines not only the procedure, it also serves as a protective mechanism against corruption and loss of money through excessively simple procedures. Violations of those rules, without having an approved exception, may lead to large financial losses and possibly bring the project itself into disrepute, as seen in the "INSIEME" scandal in Switzerland (FDFA, 2016, p. 6; FDF, 2012).

Even if there are still special restrictions for some sensitive areas such as national defence, the methods mentioned below will also be used for such procurement projects, but are regulated more specifically and are rather an exception. Examples are 41 U.S. Code for non-department of defence procurements and 10 U.S. Code for department of defence procurements.

2.1.2.2 Procurement procedures

In the figure above and similarly in global regulations four main procurement procedures can be identified.

- **Direct award**
- **Invitation procedure**
- **International selective procedure**
- **International open procedure**

Direct award as the lowest level means that the procurement is given directly to a supplier without consultation of other offerors, i.e. without competition (FDFA, 2016, p. 7).

Invitation procedure means, that the procurement authority selects a certain number of potential suppliers and invites them directly to submit their offers. No publishing of the project and invitation to tender is done with this method. In Switzerland at least three suppliers must be invited if possible (FDFA, 2016, p. 7).

International selective procedure involves in a first step publication of the project to reach out to international suppliers. Interested suppliers can then submit an expression of interest. The procurement authority selects among the interested offerors those that are suitable. These are then in the second step invited to submit their offer (FDFA, 2016, p. 8).

International open procedure is required for projects over a certain size, which must be published in an appropriate fashion to reach out to international suppliers. Interested parties can then submit an offer within a certain time limit (e.g. in Switzerland 40 days). After the bidding phase, the procurement authority then decides and selects the offeror that will be awarded with the contract. The awarding

of the mandate should be published too, as is this the case in Switzerland. (FDFA, 2016, p. 7).

It is possible that projects even without exceeding a certain threshold are handled by using the procedure of a higher level. This aims at increasing competition and reducing the danger of corruption or lowering the risk of conflicts of interest (FDFA, 2016, p. 5).

For both, international selective and international open procedure a modus with the right to appeal is possible. In this case, a respective deadline must be granted (FDFA, 2016, p. 7).

Further, for both international procurement procedures the use of electronic systems is highly recommended and seen as effective measure against corruption and mismanagement. This is subject of many procurement regulations and international treaties (Maciejewski & Ratcliff, 2019, pp. 2-4; OECD, 2016, p. 22; WTO, 2012, p. 5).

2.1.3   Summary

Government administrations on behalf of their countries, public organisations and supranational organizations have to participate as buyers in the global market to fulfil their duties and to provide the public goods, only they can offer. To acquire these input factors, highly regulated procurement processes have been established.

So far, the following definition for "public procurement" has been elaborated:

Public procurement means every procedure for procurement by contracting authorities with respect to public contracts, starting with the process for determining a need for property or service and ending with contract completion and closeout, under the principles of efficiency/proportionality, equal treatment of providers, competition and transparency.

It has been shown that two of the four procurement procedures are subjected to include an international publication. The international selective procedure and the

international open procedure, both used for projects with the highest level of complexity and highest estimated costs. Such projects are rather vulnerable to corruption and mismanagement. To counteract this risk and ensure responsible handling of taxpayers' money, modern procurement regulations are based on the four principles of efficiency/proportionality, equal treatment of providers, competition and transparency. Important global institutions highly recommend the use of electronic procurement systems to meet these principles and increase the quality of public procurement.

2.2 What is public e-procurement

Before the internet and related technologies emerged, the public procurement process was mainly analogous. With the rise of digital technologies, new ways for public procurement became possible. Those digital tools can be summarized under the term "public e-procurement" (Gebauer, Beam, & Segev, 1998, pp. 167-176).

2.2.1 Overview

With the tools provided by e-procurement the different procurement procedures, particularly the international selective procedure and international open procedure, are becoming digitized. This means the whole process of the procurement is done online, ideally on a specially designed web portal or on separate webpages for key areas. The key areas e-procurement should cover according to the European Bank for Reconstruction and Development (2015, pp. 13-14) are:

- **e-Tendering**
- **e-Purchasing**
- **e-Contract Management**

e-Tendering means the publication of a project that qualifies for an international selective or open procedure via an internet-based portal. Interested suppliers can obtain all the relevant data and documents concerning the procurement and submit their expression of interest or their offer via the internet over said portal (European Bank for Reconstruction and Development, 2015, p. 13).

e-Purchasing, also known as e-Marketplace, is a web-based catalogue in which suppliers can be registered together with the goods they offer. It is similar to a standard web shop, but with selected suppliers. This solution is mainly designed to facilitate the direct award and invitation procedure for procurement of standard goods of low value and high volume, or tenders with framework agreements. The entire process of procurement, namely the publication of items online by the suppliers, the electronic selection, the order, the reception and the payments by the procurement authority should be supported by such a system (European Bank for Reconstruction and Development, 2015, p. 14; Bravo Martín & García-Peñalvo, 2013, p. 34).

e-Contract Management "is the electronic enhancement of the management of receivables, payments, contract settlements, contract variations, performance securities, and auditing and control activities" (European Bank for Reconstruction and Development, 2015, p. 14).

2.2.2   *Functionalities of an e-tendering-/e-procurement-portal*

The focus in this work lies clearly on the e-tendering aspect of e-procurement. However, in the following a short overview over the different parts of the e-tendering process shall be given. Bravo Martín & García-Peñalvo (2013, p. 35) identify in their analysis of the e-procurement process ten functionalities a portal must provide.
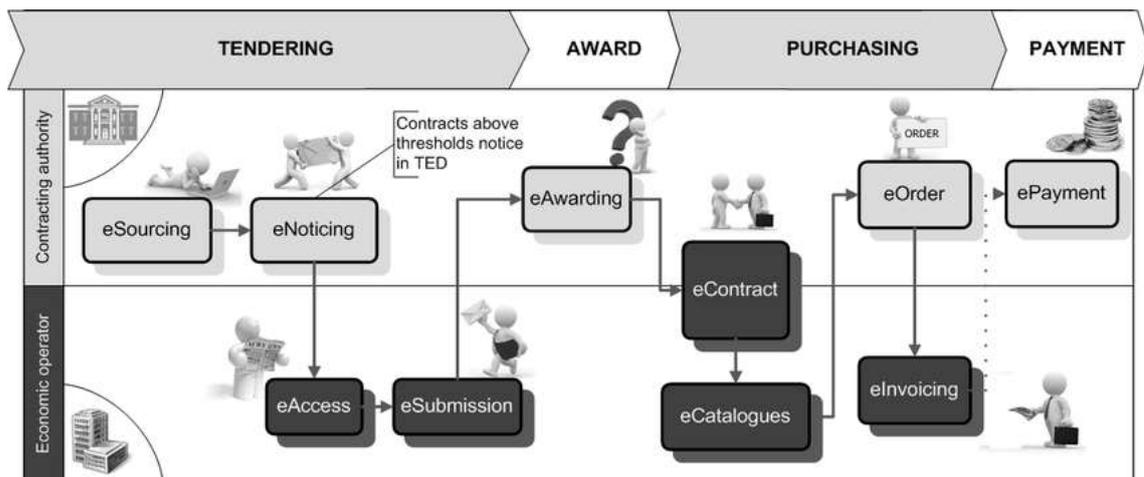
Figure 6: Functionalities covered by the public e-procurement process (Bravo Martín & García-Peñalvo, 2013, p. 35).

The process starts with **e-Sourcing**. A contraction authority collects and reuses information as a preparation for an upcoming procurement. During this preparation,

an estimation of the financial expenditure is made, and the project is assigned to a procurement procedure based on the thresholds set by law. According to the specified procedure (in this case international selective or open procedure) a notice is published via the **e-Noticing** functionalities of the procurement portal. This includes either a call to offer or a call for an expression of interest, depending on the procedure. Interested suppliers have now the opportunity to view the procurement documents and details via **e-Access** and to submit their **e-Submission** to the contracting authority via the e-access-interface by using an electronic format.

After examining the submissions, the procurement authority then assigns the procurement to the best offeror. This is also done in electronic form by means of the e-access-interface. This step is called **e-Awarding**. It includes information of the other competitors and the public via another e-notice. The conclusion, monitoring and management of the **e-Contract** or the inclusion into an **e-Catalogues** (for future international selective procedures) is done electronically by the procurement authority on the portal as well. **e-Order**, **e-Invoicing** and **e-Payment** functionalities are completing the procurement process.

The remainder of this work will focus on the tendering and the award phase.

2.2.3   *Benefits of using e-procurement methods*

As stated, an extensive implementation of e-procurement measures in the public sector is highly recommended by experts and institutions worldwide; not at least because of the advantages they provide with regards to all four principles of public procurement (Maciejewski & Ratcliff, 2019, pp. 2-4; OECD, 2016, p. 22; WTO, 2012, p. 5). In the following the most prominent benefits of e-procurement shall be elaborated with regards to the four stated procurement principles.

2.2.3.1   Benefits with regards to efficiency/proportionality

Even if the initial costs related to the implementation of a dedicated e-procurement system seem high, on the long run an increase in efficiency and cost savings can be expected. This is achieved through lower procurement costs, an increase in competition and lower administrative expenses due to the automation such a system

entails (European Bank for Reconstruction and Development, 2015, p. 16; Maciejewski & Ratcliff, 2019, p. 1).

The data gathered overtime can subsequently be used to enhance the future projecting and planning, which again results in lower costs and time savings (European Bank for Reconstruction and Development, 2015, p. 16).

Automation also leads to a transfer of knowledge into the system, which increases the learning curves of the personnel and facilitates reforming or restructuring of the procurement process (European Bank for Reconstruction and Development, 2015, p. 17).

2.2.3.2   Benefits with regards to equal treatment of providers

The implementation of e-procurement measures reduces direct interactions between procurement officials and suppliers (OECD, 2016, p. 22). Other than humans, an automated system functions as it is programmed. If no discriminatory rules have been implemented in the process (e.g. barriers for foreign suppliers at registration) (RAMBOLL/HTW Huhr, 2011, p. 91-92), every user of the system is treated equally. This means every supplier has the same e-access-interface and relevant information is provided at the same time by e-Noticing to all participants. All suppliers must provide the same data as specified in the procurement details via the same electronics ways. And after a deadline, no submissions for that specific procurement can be submitted anymore (Bravo Martín & García-Peñalvo, 2013, p. 35; Konkurrensverket, 2018).

2.2.3.3   Benefits with regards to competition

Using e-procurement measures with their, in comparison to traditional media potentially bigger range can provide greater market access. With the ability to adapt a portal to the user's language (if implemented) cross boarder procurement can be and is enhanced (Bravo Martín & García-Peñalvo, 2013, pp. 40-41; OECD, 2016, p. 22). All these opportunities of an e-procurement infrastructure are facilitating competition. As already mentioned, an increase in competition lowers prices of goods and services and increases their quality (Maciejewski & Ratcliff, 2019, p. 1; OECD, 2016, p. 15). But that is not the only benefit more competition can provide. Maciejewski & Ratcliff (2019, p. 1) state that more competition in the local market

enhances the competitiveness of the participating suppliers. This strengthens their ability to compete in other markets.

2.2.3.4 Benefits with regards to transparency

According to the European Bank for Reconstruction and Development (2015, p. 16) e-procurement with its automated recordings of every step that occurs during a procurement process, can provide real-time data on the entire process. This enhances governance in the public sector and increases transparency. The increase in transparency, together with adequate and timely information to the public, contributes to combating the risk of corruption and mismanagement of taxpayers' funds (OECD, 2016, p. 15). Podkolzina, Pivovarova and Balsevich, (2011, pp. 7-11) confirm in their case study that more transparency negatively affects the level of corruption. Additionally, Evenett & Hoekman (2005, p. 178) show that more information transparency leads to an increased utilization of control mechanisms and consequently attracts more opportunistic suppliers. Therefore, lowering again the threat of potential collusion.

2.3 Public e-procurement infrastructure

In the context to this work e-procurement infrastructure refers to the entire range of e-procurement portals in a country. The evaluation of "Service Quality" and "Data Access" is done by focusing on the e-tendering portal. E-Purchasing portals or e-marketplaces cannot be evaluated in a meaningful way from an outside perspective, due to the lack of access as a non-registered outsider.

Many countries have portals used to publish government data separate from the e-procurement portals. In such cases, the data portal is considered part of the e-procurement infrastructure.

2.4 Service quality

In the course of this work a framework to assess the service quality of a procurement portal based on a framework developed to measure the quality of a web portal will be elaborated. In this work, "Service Quality" shall be defined to reflect the quality of a

portal as perceived by a potential supplier. In addition, only what is freely accessible without payment or subscription can be assessed.

Designing the framework, the focus is on procurement barriers and best practice recommendations as measure for quality. Therefore, an assessment of the underlying architecture, running or maintenance costs, security aspects or the quality perceived by the contraction authority of a portal cannot be considered as parts of "Service Quality". Special care was taken to ensure that visual design aspects and cultural aspects are not part of the quality assessment.

2.5 Data access

The characteristic "Data Access" shall reflect how a country does provide the procurement data. Attention is paid to the provided data format and the options to access data a procurement authority gives to the public. The assessment framework used in this work is based on the Open Contracting Data Standard, but will investigate neither the data formatting nor the data structure.

It is assumed that free formats are better than proprietary ones, and that providing an API is better than just providing a file.

2.6 Country-level: The geographical nomenclature used in this thesis

During this work one unexpected difficulty arose. There is more than one concept on how to distinguish what a continent is and hence how many continents there are (Cribby, 2019). Also, the number and demarcation of countries and their respective assignment to a continent is disputable (Political Geography Now, 2019).

In order to guarantee continuity in this thesis, the geographical nomenclature of the United Nations (UN) is used. There are 195 UN member and observer states. Additionally, there are eleven further states and territorial areas with some significance. The goal is to represent the world as complete as possible (Political Geography Now, 2019). The UN nomenclature is in many ways congruent with the geographical nomenclature used by the provider of the secondary data. This data is used as factors characterizing the respective countries in this work. An evaluation of

the data by continents is rather complicated, therefore the data will be assessed in accordance with UN regional groups.

Country level means that the procurement authority operating a portal is at the level of the government of country. No super-ordinated and no sub-ordinated levels (e.g. state or communal level) are examined. Additionally, the procurement portal must be one of non-department of defence procurements.

3 Framework development

To evaluate both the "Service Quality" and the "Data Access" provided by public e-procurement portals, a suitable assessment framework must be developed. In order to keep this work within reasonable limits, an overarching strategy containing principles and limits must be determined.

3.1 Principles and strategy

As a starting point, each individual e-procurement portal on a country level must be found and recorded in an index. Therefore, a way to identify and assign a certain portal to a certain country is needed. It is evident to use the name of the respective country of origin as an identifier. While the majority of countries is unproblematic to identify as a country, some regions are disputed, or have more than one single name. In order to ensure the greatest possible inclusion of the regions, the 195 UN members and observer states together with the eleven additional states and Hong Kong were defined as the basis for the index (for more see 2.6).

3.1.1   Perspective

It has to be determined from which perspective the e-procurement portals shall be evaluated. It was specified that the evaluation will be carried out from the perspective of external observers. This external perspective was chosen for two reasons. First, it allows an evaluation of limited scope, such as that carried out in the context of this work, particularly considering the large number of infrastructure elements to be examined. Second, an external perspective is consistent with the one of potential suppliers while approaching a public e-procurement portal the first time and while interacting with it later on.

3.1.2   What is being investigated?

As already stated, this work will look into the "Service Quality" and "Data Access" of a country's e-procurement infrastructure. These two aspects are seen as significant with regard to the benefits and principles of public e-procurement.

3.1.2.1   Why "Service Quality"?

As it has been shown in chapter 2 of this work, one of the theoretical advantages of such a portal is its greater reach, and with that an increase in efficiency for the suppliers through easier and better access to public projects. Additionally, more suppliers using a portal means naturally more competition and more competition is beneficial not only to the country's government, but also to the public.

With the implementation of electronic, internet-based procurement options, a basis for achieving these benefits is created. It is assumed, that with an increase in quality of such an offer, the impact will be even higher. (Delone & McLean, 2003; Mardiana, Tjakraatmadja & Aprianingsih, 2015, p. 359). Today, there are still barriers obstructing an ideal use of public e-procurement portals. These obstacles are especially inhibiting with regard to cross-border procurements (RAMBOLL/HTW Huhr, 2011, p. 91-92). The factor "Service Quality" attempts to depict the quality differences that distinguish the different country portals, and that hinder their effectiveness in providing their full potential benefits.

3.1.2.2   Why "Data Access"?

The second great advantage of an e-procurement infrastructure is its ability to record and provide procurement data. While the first is a technical aspect, the second is rather political. Yet, a core benefit of an e-procurement infrastructure is the data provided to the public ideally in form of open government data. As already stated, more transparency with regards to procurement information has not only the benefit of lowering the risk of corruption, it also leads to lower prices and better quality. Evenett & Hoekman (2005, p. 178) show that more information transparency leads to an increased utilization of control mechanisms and consequently attracts more opportunistic suppliers. Therefore, it lowers the threat of potential collusion and subsequently also the costs of procurements. With better or easier access to the data, these effects can become even stronger, because it enables offerors and interested parties to better use them.

With that in mind, providing procurement information to the public should be a governmental goal and is seen as eminent factor of an e-procurement infrastructure.

"Service Quality" and "Data Access" influence how many suppliers an e-procurement system can attract. Therefore, these two factors are worth investigating.

3.1.3   Principles

The following principles have been set to make the evaluation framework and the application process as fair and just as possible.

The framework must be…

- **globally applicable,**
- **treating every country the same,**
- **non-discriminatory to cultural aspects** (besides language), and
- **ignoring visual design aspects.**

Additionally,

- **enough time and effort are spent to find a portal if there is one,** and
- **the evaluation is carried out without registration.**

3.2   Overview section of evaluation framework

In the "Overview" section of the evaluation framework metadata will be recorded and presented. For each country the official name (according to the UN name scheme, if there is any) together with the UN Regional Group description for a later evaluation shall be recorded. In the field "URL" the web address of the portal to be examined will be listed. If there are more than one portal, the portal presented as the main procurement portal by the respective country or the portal, which seems to be the main portal (see details for these terminations in Appendix A) is identified in the "URL" field, while the others are recorded under "Additional URLs".

If decisions with regard to multiple portals have been made or other particularities have occurred, it will be briefly described in the "Comments" section.

Additionally, the "Overview" section shall provide the final scores for "Service Quality" and "Data Access". The final framework for the "Overview" section is designed as seen below.

Overview			
Country:		UN Regional Group:	
URL:			
Additional URLs:			
Comments:			
Service Quality Score:	/10	Level of Access to Data:	★ ★ ★ ★ ★ /5

Figure 7: "Overview" section of the evaluation framework.

3.3 e-Procurement infrastructure service quality

To design a suitable framework for the evaluation of the "Service Quality" of an e-procurement infrastructure, more preparation is necessary.

3.3.1 Preparations and considerations: Service quality

At first, it must be examined, which quality characteristics are influencing the user. As stated, the user is a potential supplier who is using the infrastructure.
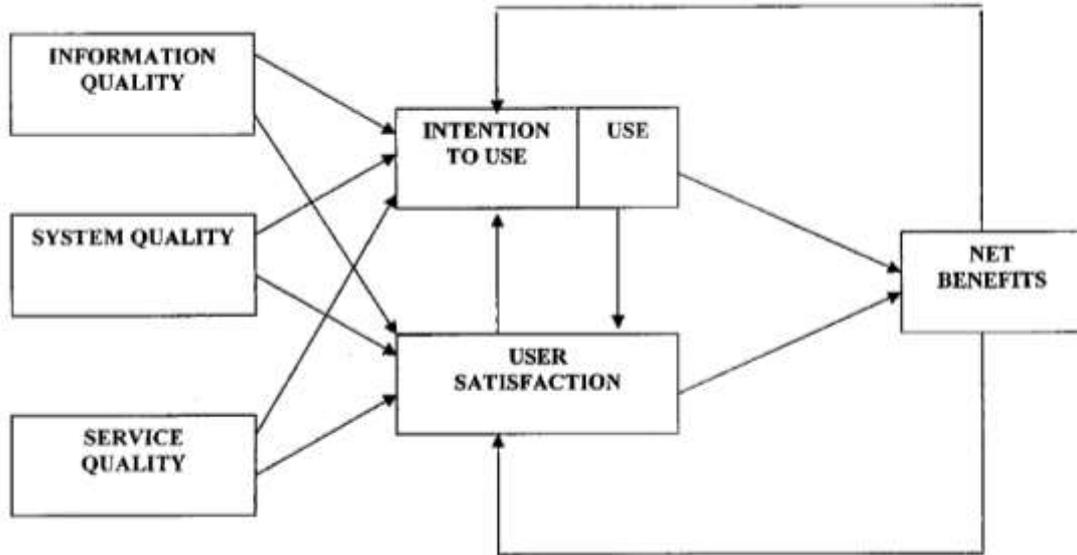
Figure 8: DeLone and McLean (2003, p. 24) updated IS success model used as a base to determine
"Service Quality".

DeLone and McLean postulate in their 2003 (p. 24) updated IS success model that information, system and service quality have an impact on the user satisfaction and the intention to use the system of a potential supplier. Mardiana, Tjakraatmadja and Aprianingsih (2015, p. 359) are confirming that service and system quality together with the perceived usefulness of the system have a direct impact on the intention to use. For information quality, they cannot find significant evidence. However, their study has been done from an inside perspective, meaning the user behaviour of government employees was investigated. Thus, in our context their results should be considered with care, since government employees are required to use the information system as part of their job.

From a supplier's perspective, information quality seems to be critical. Particularly if considering, that the OECD (2009, p. 64) lists in its "OECD Principles for Integrity in Public Procurement" guidelines minimal requirements for the information that must be contained in a call to tender notice.

It seems impossible to provide a deeper analysis of the information given on a respective e-procurement portal within the scope of this work. Thus only fulfilment of this set of minimal requirements by the OECD shall be looked at as a part of the service quality of the portal.

Based on DeLone and McLean's work, Yang, Shaoha, Zhen and Zhou (2005) developed an instrument to measure the user perceived service quality of information presenting web portals.
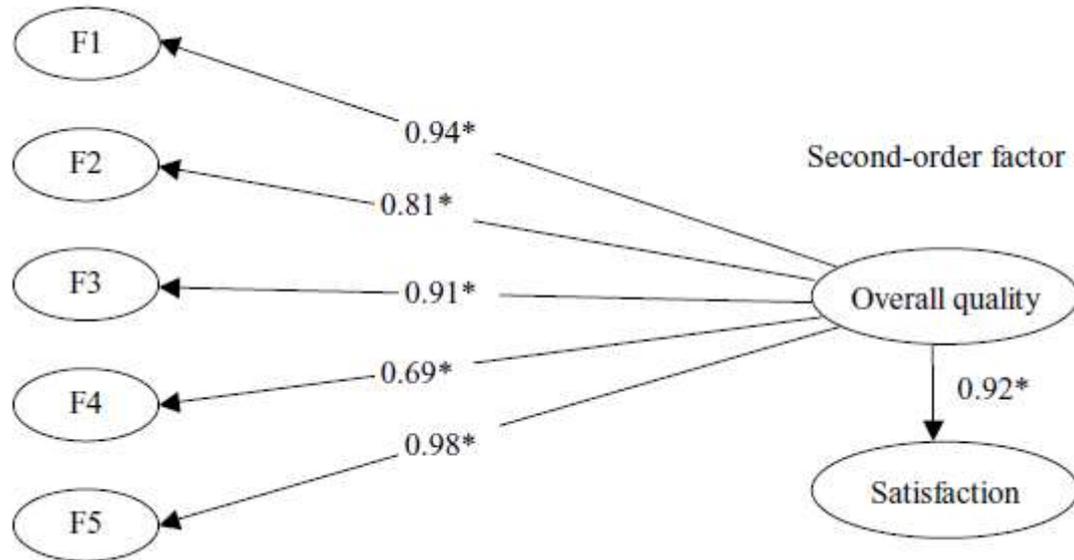
Figure 9: Yang, Shaoha, Zhen and Zhou's (2005, p. 584) five-factor instrument. F1: usability; F2: usefulness of content; F3: adequacy of information; F4: accessibility; F5: interaction.; *P < 0:001.

In their five-factor instrument, they identify five primary factors directly influencing the overall service quality evaluation by the users of an information presenting web portal. In addition to these, Yang, Shaoha, Zhen and Zhou (2005, p. 582) identified second-order factors contributing to the five primary factors (for the factors and items see table 1 below).

Table 1: Primary and second-order factors of the five-factor instrument by Yang, Shaoha, Zhen and Zhou (2005, p. 582).

Usability	• Customized search functions • Search facilities • Well-organized hyperlinks • Customized information presentation • (Confidentiality for customer information) • (Adequacy of security features)
Usefulness of content	• Relevant information for the customer • Up-to-date information • Valuable tips on products/services

	• Unique content
Adequacy of information	• Complete product/service description
	• Information comprehensiveness relative to other portals
	• Complete content
	• Sufficiency of information
	• Detailed contact information
Accessibility	• Accessibility of the portal
	• High speed of page loading
Interaction	• Follow-up services to customers
	• Message board forum

Based on this five-factor instrument, the framework for evaluating the e-procurement portals with regard to "Service Quality" will be developed. Among the primary factors new criteria representing the second-order factors shall be found. Already matching criteria will be kept, and the new ones shall be suited and adapted specifically to evaluate an e-procurement portal.

3.3.2   Adaptation: Service quality

With the goal of finding suitable criteria to attribute the five primary factors of the framework, an evaluation of best e-procurement practices, e-procurement guidelines and procurement barriers must be done.

As mentioned in the previous chapter, information and service quality are not easy to separate with regards to an e-procurement portal. Therefore, the primary factors usefulness of content and adequacy of information will be used uniformly.

To limit the scope of this work, a total of ten criteria shall be found. Each of the primary factors shall at least contain two second-order factors.

3.3.2.1   Accessibility

Accessibility describes the ability of the portal to provide data in a way that allows a user to locate and access the needed information or content without difficulties (Yang, Shaoha, Zhen & Zhou, 2005, p. 585).

In the context of e-procurement accessibility is part of the principle of transparency. Governments should ensure access to all procurement relevant information as widely as possible and in a user-friendly manner (OECD, 2009, p. 22).

Criterion 1: Access is free of charge?

The WTO (2012, pp. 18-19) is encouraging procurement authorities "to publish their notices by electronic means free of charge". The waiver of a paywall is also mentioned in the guidelines concerning e-procurement by the European Bank for Reconstruction and Development (2015, p. 89). They describe best practices as providing "free and open access to all information" and allowing bidders to "submit bids online without any charges." Under certain restricted circumstances a fee may be charged.

Criterion 2: Tenders visible without registration?

The WTO (2012, pp. 22-23) guidelines on procurement state that a procurement authority "shall not adopt or apply any registration system or qualification procedure with the purpose or the effect of creating unnecessary obstacles to the participation of suppliers." The WTO accepts the use of a registration system for bidding or the registration for participation as supplier, but a mandatory registration for accessing and reading current tenders and procurement data is considered an unnecessary obstacle.

3.3.2.2   Usability

Yang, Shaoha, Zhen and Zhou (2005, p. 585) describe the primary attribute "Usability" as intuitive and user-friendly designed websites. This includes easy to use search and navigation functionalities and functions allowing customization or personalization of the page. Further they mention visual design elements and the appearance of a web portal.

With regards to e-procurement there are not that many differences. The focus lays on the search and navigation function as well as the customization aspect, which a web portal with high usability should provide. To prevent discrimination with regards to cultural differences visual design aspects will not be taken into account in this work

(e.g. what is perceived as an appealing design in Asia is not necessarily perceived that same way in South America, etc.).

Criterion 3: Search function available?

The European Bank for Reconstruction and Development (2015, p. 46) lists in its guidelines search engines, which allow for an effective sector, product and market browsing, as a standard for an e-procurement portal. This is also listed as a secondary-order criterion in Yang, Shaoha, Zhen and Zhou's (2005, p. 582) work.

Criterion 4: English offered as a language option for portal?

Yang, Shaoha, Zhen and Zhou (2005, p. 582) include customization aspects of a portal as part of "Usability". In a world where language barriers are still representing a major obstacle for cross-border procurement, the ability of a portal to support different languages is a valuable customization functionality (RAMBOLL/HTW Huhr, 2011, pp. 79-80).

For this criterion, English has been chosen as the language that at least must be supported, due to its position as business and world language (British Council, 2013).

Criterion 5: One or multiple portals?

Having a single portal to access all (non-defence) public procurements is considered an essential benefit of an e-procurement infrastructure by many publications (European Bank for Reconstruction and Development, 2015, p. 46; WTO, 2012, p. 19), and is clearly improving the usability of said infrastructure.

3.3.2.3   Usefulness of content and adequacy of information

Both primary criteria are analysed together, because they are difficult to separate for the application purpose in this work.

Yang, Shaoha, Zhen and Zhou (2005, p. 578) describe "Usefulness of Content" as the relevance and "Adequacy of Information" as the extent to which the information is complete. This includes accuracy, consistency and the necessity to provide information that facilitates the understanding by the user.

For an e-procurement infrastructure, providing information is key to its purpose. The information should be provided timely, relevant as well as including everything a potential supplier needs to know, in a form that is broadly comprehensible.

<u>Criterion 6</u>: Provided information is up to date?

One of the main purposes of every e-procurement portal is to provide information on future projects for which potential suppliers can make an offer. Thus, the information provided must be up-to-date. Up-to-date information is also directly mentioned as a secondary-order criterion in Yang, Shaoha, Zhen and Zhou's (2005, p. 582) work.

It is recognized that for small countries in particularly, projects exceeding the threshold for open procurements may be rare. Therefore, a suitable approach to represent this issue will be chosen when applying the framework.

<u>Criterion 7</u>: All relevant information offered?

It would be contrary to the principle of efficiency if the procurement authority would not provide all the information needed to submit an offer. With regard to different projects, the term sufficient information may vary. Under certain circumstances more information is needed, especially if the project is of a certain complexity. Therefore, only the minimal requirements stated by the OECD (2009, p. 64) and others (WTO, 2012, p.19; Directive 2014/24/EU, Part H) will serve as base for this evaluation of the relevance of the information provided.

To answer the question of information relevance, a sub-framework has been created. Only if all the following requirements are met, the criterion of "All relevant information offered?" is considered to be fulfilled.

- **Time Limit (Start and End) is set**
- **Procurement documents are provided**
- **Selection Criteria are provided**
- **Contact Details are provided**

Criterion 8: English offered as language option for tender?

As already mentioned, it is important which languages are supported in a procurement portal. Criterion 4 was concerned with the customization aspects of the main portal. But providing different language encompasses more. It allows for a greater geographical reach and enables participation of suppliers from abroad, promoting cross-border procurement (RAMBOLL/HTW Huhr, 2011, pp. 79-80). Since English is the language of international business, it is obvious to base the evaluation on the criterion whether an e-procurement infrastructure provides its information in English or not (British Council, 2013).

3.3.2.4   Interaction

Yang, Shaoha, Zhen and Zhou's (2005, p. 579) describe the factor "Service Quality" to be involved in three types of interactions. They list operations between "users and service providers' employees, users and the web site, and among peer users of similar products." They acknowledge, that the process of using such a portal is primarily self-served and the focus is on the automated services a portal provides. However, the interactions also involve personal services by a contact person.

From an outside perspective an evaluation of these aspects of a portal is rather difficult. Therefore, in the course of this work, the emphasis will be placed on which interactive features an e-procurement infrastructure is providing for its users.

Criterion 9: Web interface available?

The guidelines for successful electronic procurement mention that an e-procurement portal should provide a single point of access together with a unified interface from where the suppliers have access to all the functions the portal provides for them. This so-called web interface between the suppliers and the procurement authority is normally part of the standard features of an e-procurement system (European Bank for Reconstruction and Development, 2015, pp. 46-49).

Criterion 10: API available?

The last criterion is concerned with the interaction benefits an e-procurement portal providing an API brings. The European Bank for Reconstruction and Development

(2015, p. 44) mentions the employment of an API in their e-procurement guidelines as best practice for exchanging procurement data.

In practice two variations in providing APIs conceivable. Providing direct access to the procurement data or providing an API to released procurement data records on a government's open data portal. Both of them will be considered as API fulfilling the tenth criterion.

3.3.3   Scale: e-Procurement infrastructure service quality

Yang, Shaoha, Zhen and Zhou's (2005) discuss to what extent the secondary-order criteria are contributing to the five primary factors. This information is not available for the new criteria elaborated before. Hence, it is not known how high the weight of the individual criteria as well as the primary factors with regards to the service quality of a portal in effect are. What is known is the more of the criteria are fulfilled, the higher is the expected service quality of an e-procurement infrastructure. Therefore, the chosen analytical method is based on an ordinal scale (Field, Miles & Field; 2012, p. 10). This means between zero (no e-procurement infrastructure) and ten points (best conceivable service quality), the quality gain per additional point is not defined. However, it can be stated that a country with a higher score provides a better service as one with a lower score.

3.3.4   Summary: e-Procurement infrastructure service quality

Every country's e-procurement infrastructure will be evaluated base on the ten criteria elaborated in the chapters before. These are based on Yang, Shaoha, Zhen and Zhou's (2005) five-factor instrument for the evaluation of the service quality of information providing web portals as well as on modern e-procurement guidelines. The evaluation framework for a country's e-procurement infrastructure is shown below.

Evaluation of the infrastructure service quality		
Accessibility:	Access is free of charge?	Yes/No/Points
	Tenders visible without registration?	Yes/No/Points
Usability:	Search function available?	Yes/No/Points
	English offered as a language option for portal?	Yes/No/Points
	Languages:	

	One or multiple portals?	Yes/No/Points
Usefulness of Content and Adequacy of Information:	Provided information is up to date? (2019 or more recent)	Yes/No/Points
	All relevant information offered? (Defined framework)	Yes/No/Points
	English offered as language option for tender?	Yes/No/Points
	Languages:	
Interaction:	Web interface available?	Yes/No/Points
	API available?	Yes/No/Points
	APIs:	
	Comments Data:	
Score:		/10

Figure 10: Evaluation framework for infrastructure service quality.

For the two criteria where the language is relevant, the available language(s) will be recorded in the box below. Additional comments regarding the data provided are also recorded.

To evaluate whether a portal offers all the relevant information, a sub-framework was created. If one or more of these minimal standards are not met, the point for information relevancy cannot be awarded. This sub-framework is shown in the table below.

Minimal Standards for Tenders*		
Time limit (start and end) is set:	Yes	No
Procurement documents are provided:	Yes	No
Selection criteria are provided:	Yes	No
Contact details are provided:	Yes	No
All criteria have to be met to fulfil the criterion "All relevant information offered? "		

Figure 11: Sub-framework for assessing the relevancy of the provided Information.

As stated above, the total scores resulting from the evaluation of the e-procurement infrastructures according to this framework are scaled ordinally. This means comparing the countries in form of a ranking of their service quality is possible, but no assessment of the quality gain by an additional point can be made.

3.4 Data access

Providing data is a central task of an e-procurement infrastructure. It serves the principle of transparency and can help to fight the risk of corruption. For its assessment, an evaluation framework similar to the one for "Service Quality" hast to be developed.

3.4.1 Preparation and considerations: Data access

As preparation for the evaluation framework on how an e-procurement infrastructure provides its procurement data to the public, procurement guidelines and best practices were examined. Unfortunately, beside an API as best practice, not much else could be found (European Bank for Reconstruction and Development 2015, p. 44). There is simply the agreement that procurement data should be published to improve transparency. Therefore, for the evaluation the access to data of an e-procurement infrastructure, this work relies on the Open Contracting Data Standard.[11]

The Open Contracting Data Standard provides guidelines on how governments should provide their procurement data to the public with respect to an open and free use (open licensing). It introduces a five-star scoring system, evaluating the way the data is provided and how it is structured within the provided files (see figure 12). Additionally, it contains an identification system used to link and cross-reference data at all stages of a contracting process and to other related data sets.

---

[11] See Open Contracting Data Standard: Documentation, available at: https://standard.open-contracting.org/latest/en/, web access 26. January 2019.
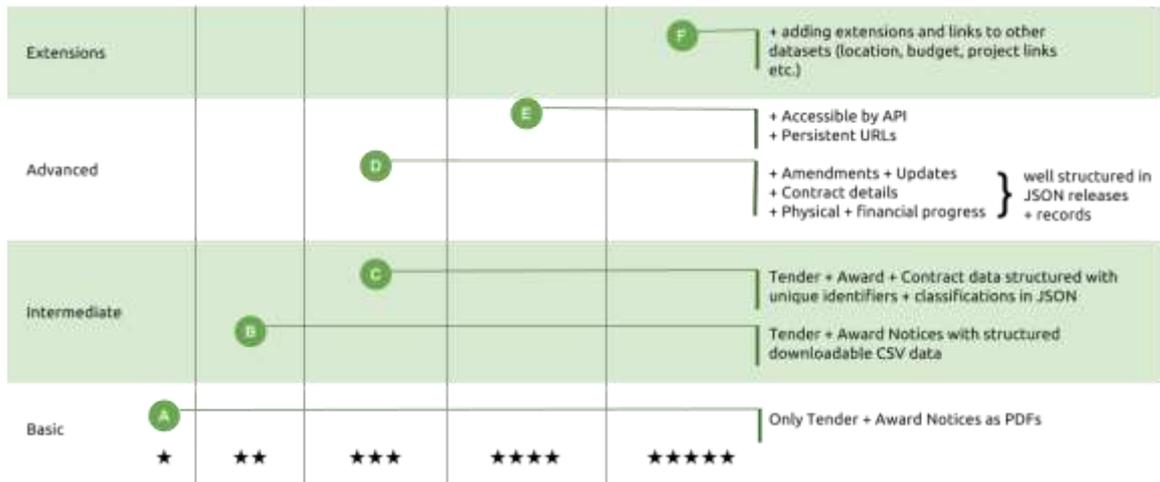
Figure 12: Original Open Contracting Data Standard scheme.[12]

This thesis will only evaluate how the data is provided, which is directly adopted from the scheme presented in the Open Contracting Data Standard. How the data is structured within a certain file format and whether it matches the Open Contracting Data Standard guidelines, will not be part of this evaluation. In the evaluation of 207 nations, such an in-depth analysis would go beyond the scope of this work. It is only reviewed whether the data is structured, but not whether the identifiers used are in compliance with the Open Contracting Data Standard.

3.4.2   Adaptation: Data access

The scores awarded for each way in which a portal provides its data are as follows:

<u>**Score of 0:**</u>

No data is provided, or no e-procurement infrastructure is found for this country.

<u>**Score of 1:**</u>

Contrary to the Open Contracting Data Standard, releases of tender and award notices are in a non-machine-readable format. This includes PDFs, word files, non-machine-readable releases on websites as well as proprietary excel formats. Excel formats have been included, despite the fact that some of them are potentially

---

[12] See Open Contracting Data Standard: Documentation: Docs » Implementation guidance » What to publish, available at: https://standard.open-contracting.org/latest/en/implementation/levels/, web access 26. January 2019.

machine-readable, to take into account that their handling is not optimal in terms of data analysis. The Open Contracting Data Standard does not classify them at all.

Score of 2:

The e-procurement infrastructure provides its data in machine-readable CSV files. Tender and award notices are provided either as a single CSV file or bound as a Zip file available for bulk download, both with structured data.

Score of 3:

Three points are awarded as defined in the requirements of the Open Contracting Data Standard. Tender, award, and contract data must be structured with unique identifiers and released as a CSV file. Additionally, a JSON file containing the classification of the identifiers must be provided. If there is additional data on amendments, updates, contract details and physical financial progress in a JSON file, three points are still assigned.

Score of 4:

The e-procurement infrastructures provide either a direct API to the data on the portal or providing their procurement data on an open data platform with an API.

Score of 5:

If an e-procurement infrastructure provides in addition to an API links and extensions to other data sets, five points are awarded.

3.4.3   Scale: Data access

Similar to the evaluation of the service quality of an e-procurement infrastructure, the framework for "Data Access" is ordinally scaled. This means the gain in "Data Access" per additional point is not defined. However, it can again be stated that a country with a higher score provides a better access to data as one with a lower score (Field, Miles & Field; 2012, p. 10).

3.4.4 Summary: Data access

The ability of every country's e-procurement infrastructure to provide data to the public will be evaluated with a scale ranging from zero to five points based on the Open Contracting Data Standard. The evaluation framework is based on an ordinal scale, which does not allow for determining the net-benefit per additional point. Care was taken to retain as much of the original framework as possible for potential future research. The adapted framework is shown below.

Evaluation of the access to provided data (Based on the Open Contracting Data Standard)						
Extensions						+adding extensions and links to other datasets (location, budget, project links etc.)
Advanced						Accessible by API and persistent URLs
						+Amendments +Updates; +Contract details; +Physical +financial progress → in JSON releases + records
Interme-diate						Tender + Award + Contract data structured with unique identifiers in CSV + classification in JSON
						Tender + Award Notices with structured downloadable data (bulk download, CSV)
Basic						Only tender + award notices as PDFs or other non-structured formats
	✦	✦✦	✦✦✦	✦✦✦✦	✦✦✦✦✦	
						Score: /5

Figure 13: Adapted framework for evaluating the "Data Access".

4 Data collection

To answer the research questions, data to conduct the regression analysis must be collected. The depended variables will be the total sum of points awarded for "Service Quality" and "Data Access" after applying the evaluation frameworks to the e-procurement infrastructures of the world's countries. Country related factors serving as independent factors will be taken from well-respected sources.

4.1 Dependent variable: Data collection and framework application

The following section shows how the evaluation framework has been applied to the respective portals and what peculiarities have emerged.

4.1.1 Preparation of the data collection

Before the evaluation frameworks can be applied, a register containing the relevant information for each of the 207 countries or territorial areas has to be created. As already stated, together with the name of the country or territorial area the URL's (tendering portal and if necessary open data portal) of the respective e-procurement infrastructure was recorded.

These recordings were done manually over the period from January to October 2019. To grant fair treatment to every country and territorial area a reasonable amount of time was spent to identify the relevant portal(s) and to gather the necessary data. The time required ranged from 30 minutes up to a maximum of 12 hours per country infrastructure, with an average of around three hours. To counteract the problem that some portals were not reachable, the recording date was split in two non-consecutive days and in some cases even months. To overcome language barriers, translation tools such as Google Translate[13] were employed.

---

[13] See https://translate.google.com/?hl=de.

4.1.2   Framework application: e-Procurement infrastructure service quality

In some situations, half points were awarded when applying the framework on e-procurement infrastructure service quality. Therefore, an overview on how the framework has been applied to the data shall be given here.

Accessibility

Table 2: How points are assigned in terms of accessibility.

Criteria	Description	Points given	
Access is free of charge?	Access or participation is subject to a fee, or information cannot be found.	No	0
	Access to tenders and participation are free of charge, but the access to some information is subject to a fee.	Partially yes	0.5
	Access to tenders, participation and information are free of charge.	Yes	1
Tenders visible without registration?	No tenders visible without registration.	No	0
	General tender information is visible without registration, but not the details.	Partially yes	0.5
	Tenders and details are visible without registration.	Yes	1

Usability

Table 3: How points are assigned in terms of usability.

Criteria	Description	Points given	
Search function available?	No search function is provided.	No	0
	A search function is provided, but only for searching the whole site.	Partially yes	0.5
	A designated search function for tenders is provided.	Yes	1
English offered as a language option for portal?	English is not provided as language option for the portal.	No	0

	Only parts of the portal are provided in English.	Partially yes	0.5
	English is provided as language option for the entire portal.	Yes	1
One or multiple portals?	More than one portal could be found.	No	0
	There are two or more portals but with the same content (e.g. procurement portal and electronic form of an official bulletin).	Partially yes	0.5
	Only one procurement portal could be found.	Yes	1

Usefulness of content and adequacy of information

Table 4: How points are assigned in terms of usefulness of content and adequacy of information.

Criteria	Description	Points given	
Provided information is up to date? (2019 and more recent)	The provided information is older than 1st of January 2019.	No	0
	The provided information is more recent than 1st of January 2019.	Yes	1
All relevant information offered? (Defined in framework)	One or more points of the sub-framework are not fulfilled.	No	0
	The sub-framework is fulfilled.	Yes	1
English offered as language option for tender?	English is not provided as language option for the tenders.	No	0
	Only parts of the tender information are provided in English, or only some of the tenders are provided in English.	Partially yes	0.5
	English is provided as language option for the entire tender information.	Yes	1

Interaction

Table 5: How points are assigned in terms of interaction.

Criteria	Description	Points given	
Web interface available?	No web interface is provided.	No	0
	A web interface is provided.	Yes	1
API available?	No API is provided, or no API could be found with reasonable effort.	No	0
	An FTP access to the procurement data is provided.	Partially yes	0.5
	An API is provided.	Yes	1

4.1.3   Framework application: e-Procurement infrastructure data access

During the application of the framework for "Data Access" no half points were awarded. The scoring was performed strictly according to the template shown in chapter 3.4.4.

If the data provided met the criteria of a higher level, but lacked in completeness or timeliness without a valid reason (for example a plant update of the provided procurement data every six months), they were rated at the next lower matching level.

Outdated data were not considered for the scoring. For the assessment of timeliness, the same rule was applied as for the criterion "Provided information is up to date?" from the evaluation of the service quality. In order to be considered as current, the data provided had to be no older than 1st of January 2019.

If the data provided were obviously incomplete, they were not considered for the scoring.

Detailed information on what data could be found and how the scoring was carried out in a particular case can be found for each country in Appendix A of this work.

4.1.4   Result: Framework application

Out of 207 examined countries and territorial areas, for 154 an e-procurement infrastructure could be found. Despite spending a fair amount of time on each country no portals or infrastructure could be identified for the remaining 53 countries or territorial areas.
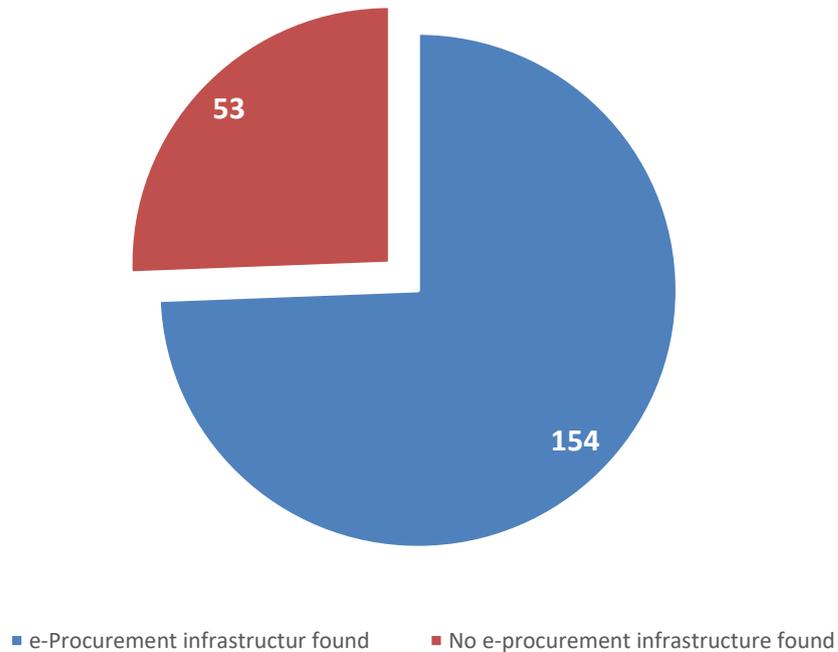
Figure 14: Frequency of countries with an e-procurement infrastructure.

The average score across all the evaluated countries for "Service Quality" is 5.5 with a median of 7. For "Data Access" the average score is 1.24 with a median of 1.

By excluding the nations or territorial areas without an e-procurement infrastructure, the average for "Service Quality" rises up to 7.39 with a median of 7.5; for "Data Access" the average is 1.66 with the median remaining 1.
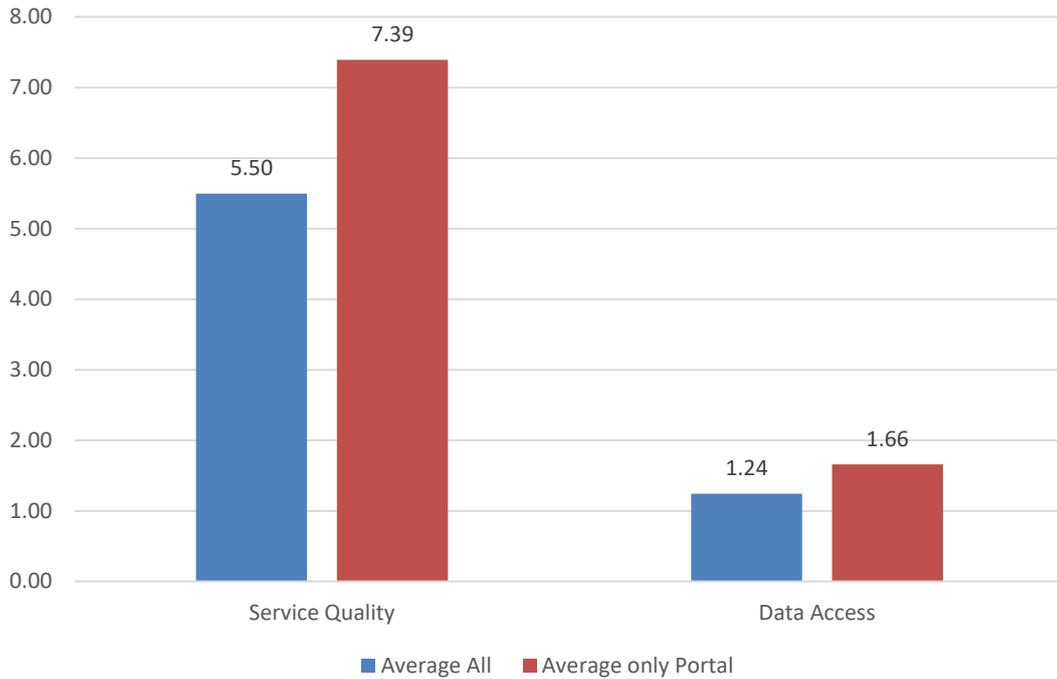
Figure 15: Average scores regarding "Service Quality" and "Data Access". Data are presented for all the examined countries (blue) and for only the nations providing a portal (red).

Under consideration of the UN Regional Groups the averages vary strongly between the different groups.
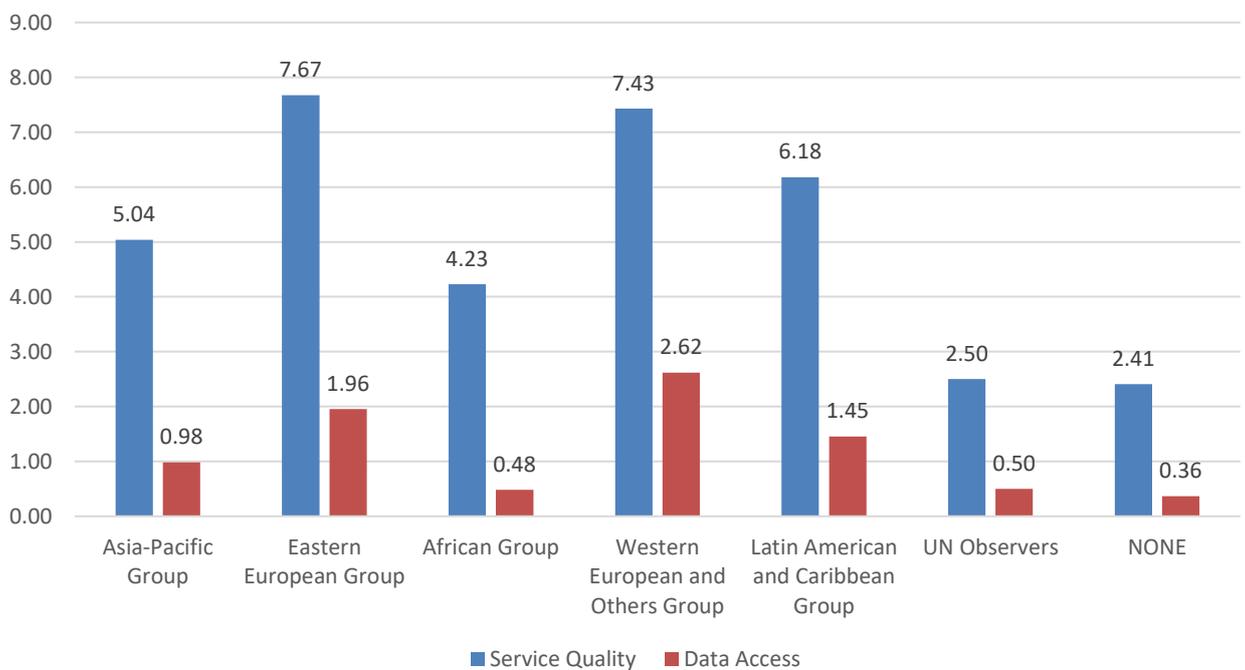
Figure 16: Average scores of each UN Regional Group (including all nations, i.e. including those without an identifiable e-procurement infrastructure).

With an average of 7.67 the score for "Service Quality" of the Eastern Europe Group is slightly higher than of the Western European and others Group. The score for "Data Access" of the Western Europe and Others Group is with an average of 2.62 by 0.66 points higher than the Eastern Europe Group. The next groups in the ranking are the Latin American and Caribbean Group with average scores of 6.18 and 1.45, followed by the Asia-Pacific Group with average scores of 5.04 and 0.98 for "Service Quality" and "Data Access", respectively. The African Group has an average score of 4.23 for "Service Quality" and 0.48 for "Data Access". UN Observer States and non-UN members are similar scored with an average of 2.5 respectively 2.41 for "Service Quality" and 0.5 respectively 0.36 for "Data Access".
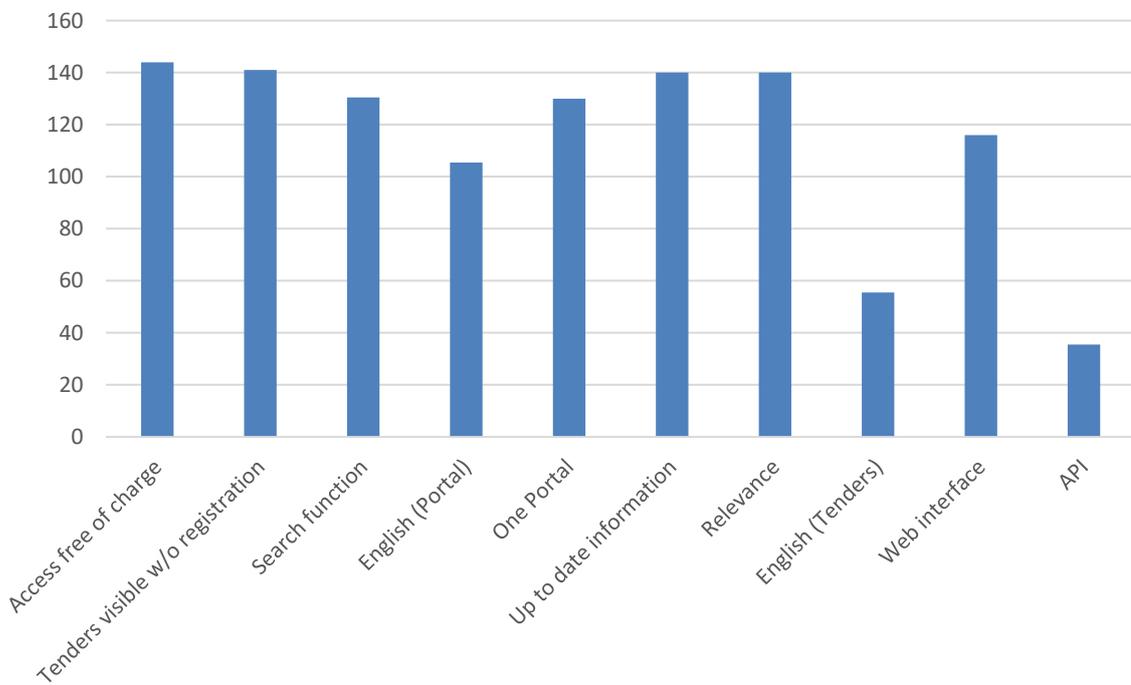
Figure 17: Cumulative scores for each Criterion of "Service Quality".

By studying the cumulated scores for each criterion of "Service Quality" it becomes apparent that language barriers still seem to be an obstacle. Further, an API is provided only by few of the infrastructures.

The following table shows the total sores for "Service Quality" and "Data Access" of each country in alphabetical order. Grey cells indicate that no e-procurement infrastructure could be found. More details can be found in the appendix A of this work.

Table 6: Total scores for "Service Quality" and "Data Access".

State	UN Regional Group	Service Quality	Data Access
Afghanistan	Asia-Pacific Group	9	4
Albania	Eastern European Group	8.5	1
Algeria	African Group	5.5	0
Andorra	Western European and Others Group	4.5	1
Angola	African Group	6.5	1
Antigua and Barbuda	Latin American and Caribbean Group	3	0
Argentina	Latin American and Caribbean Group	7	1
Armenia	Eastern European Group	6	1
Australia	Western European and Others Group	10	5
Austria	Western European and Others Group	3.5	1
Azerbaijan	Eastern European Group	8	1
Bahamas	Latin American and Caribbean Group	9	0
Bahrain	Asia-Pacific Group	9	1
Bangladesh	Asia-Pacific Group	6.5	1
Barbados	Latin American and Caribbean Group	0	0
Belarus	Eastern European Group	6	1
Belgium	Western European and Others Group	7.5	2
Belize	Latin American and Caribbean Group	7.5	1
Benin	African Group	7	1
Bhutan	Asia-Pacific Group	9	1
Bolivia (Plurinational State of)	Latin American and Caribbean Group	7	1
Bosnia and Herzegovina	Eastern European Group	8	1
Botswana	African Group	3	0
Brazil	Latin American and Caribbean Group	8	4
Brunei Darussalam	Asia-Pacific Group	0	0
Bulgaria	Eastern European Group	7.5	2
Burkina Faso	African Group	1.5	0
Burundi	African Group	5.5	1
Cabo Verde	African Group	0	0
Cambodia	Asia-Pacific Group	5.5	1
Cameroon	African Group	7	0
Canada	Western European and Others Group	10	5
Central African Republic	African Group	0	0
Chad	African Group	0	0
Chile	Latin American and Caribbean Group	8	4
China	Asia-Pacific Group	6	1

Colombia	Latin American and Caribbean Group	9	5
Comoros	African Group	0	0
Congo	African Group	0	0
Costa Rica	Latin American and Caribbean Group	7	2
Côte D'Ivoire	African Group	7	1
Croatia	Eastern European Group	6	2
Cuba	Latin American and Caribbean Group	0	0
Cyprus	Asia-Pacific Group	9	4
Czech Republic	Eastern European Group	8	2
Democratic People's Republic of Korea (North Korea)	Asia-Pacific Group	0	0
Democratic Republic of the Congo	African Group	5	1
Denmark	Western European and Others Group	7.5	1
Djibouti	African Group	0	0
Dominica	Latin American and Caribbean Group	7.5	1
Dominican Republic	Latin American and Caribbean Group	7	1
Ecuador	Latin American and Caribbean Group	7	1
Egypt	African Group	7.5	1
El Salvador	Latin American and Caribbean Group	7	1
Equatorial Guinea	African Group	0	0
Eritrea	African Group	0	0
Estonia	Eastern European Group	8.5	2
Eswatini (former Swaziland)	African Group	5.5	0
Ethiopia	African Group	6	1
Fiji	Asia-Pacific Group	9	1
Finland	Western European and Others Group	8	5
France	Western European and Others Group	8.5	4
Gabon	African Group	0	0
Gambia (Republic of The)	African Group	0	0
Georgia	Eastern European Group	8	3
Germany	Western European and Others Group	7	1
Ghana	African Group	9	2
Greece	Western European and Others Group	7	2
Grenada	Latin American and Caribbean Group	7.5	1
Guatemala	Latin American and Caribbean Group	7	1
Guinea	African Group	2	0
Guinea Bissau	African Group	0	0
Guyana	Latin American and Caribbean Group	0	0

Haiti	Latin American and Caribbean Group	8	1
Holy See (Vatican City)	UN Observers	0	0
Honduras	Latin American and Caribbean Group	7	1
Hungary	Eastern European Group	7.5	1
Iceland	Western European and Others Group	6.5	1
India	Asia-Pacific Group	8	1
Indonesia	Asia-Pacific Group	6.5	1
Iran (Islamic Republic of)	Asia-Pacific Group	0	0
Iraq	Asia-Pacific Group	0	0
Ireland	Western European and Others Group	9	1
Israel	Western European and Others Group	6	1
Italy	Western European and Others Group	8.5	4
Jamaica	Latin American and Caribbean Group	8.5	1
Japan	Asia-Pacific Group	9	4
Jordan	Asia-Pacific Group	3.5	0
Kazakhstan	Asia-Pacific Group	7	1
Kenya	African Group	8	1
Kiribati	Asia-Pacific Group	5.5	0
Kuwait	Asia-Pacific Group	8	1
Kyrgyzstan	Asia-Pacific Group	8	1
Lao People's Democratic Republic	Asia-Pacific Group	0	0
Latvia	Eastern European Group	9.5	4
Lebanon	Asia-Pacific Group	0	0
Lesotho	African Group	7.5	1
Liberia	African Group	0	1
Libya	African Group	0	0
Liechtenstein	Western European and Others Group	9	4
Lithuania	Eastern European Group	8	1
Luxembourg	Western European and Others Group	7	1
Madagascar	African Group	7	1
Malawi	African Group	8	1
Malaysia	Asia-Pacific Group	4.5	0
Maldives	Asia-Pacific Group	7.5	1
Mali	African Group	0	0
Malta	Western European and Others Group	8.5	1
Marshall Islands	Asia-Pacific Group	0	0
Mauritania	African Group	5.5	0
Mauritius	African Group	7	1

Mexico	Latin American and Caribbean Group	6	4
Micronesia (Federated States of)	Asia-Pacific Group	0	0
Monaco	Western European and Others Group	0	0
Mongolia	Asia-Pacific Group	8	1
Montenegro	Eastern European Group	8	2
Morocco	African Group	7	1
Mozambique	African Group	8	0
Myanmar	Asia-Pacific Group	0	0
Namibia	African Group	0	0
Nauru	Asia-Pacific Group	0	0
Nepal	Asia-Pacific Group	8	3
Netherlands	Western European and Others Group	8.5	4
New Zealand	Western European and Others Group	9	1
Nicaragua	Latin American and Caribbean Group	6.5	1
Niger	African Group	7	1
Nigeria	African Group	0	0
Norway	Western European and Others Group	9	4
Oman	Asia-Pacific Group	8	1
Pakistan	Asia-Pacific Group	7.5	1
Palau	Asia-Pacific Group	7.5	0
Palestine	UN Observers	5	1
Panama	Latin American and Caribbean Group	8	4
Papua New Guinea	Asia-Pacific Group	0	0
Paraguay	Latin American and Caribbean Group	8	4
Peru	Latin American and Caribbean Group	7	1
Philippines	Asia-Pacific Group	8.5	1
Poland	Eastern European Group	8	4
Portugal	Western European and Others Group	9	4
Qatar	Asia-Pacific Group	9	4
Republic of Korea (South Korea)	Asia-Pacific Group	9.5	4
Republic of Moldova	Eastern European Group	9	4
Romania	Eastern European Group	8.5	4
Russian Federation	Eastern European Group	7.5	2
Rwanda	African Group	9	1
Saint Kitts and Nevis	Latin American and Caribbean Group	0	0
Saint Lucia	Latin American and Caribbean Group	7.5	1
Saint Vincent and the Grenadines	Latin American and Caribbean Group	7.5	1
Samoa	Asia-Pacific Group	0	0
San Marino	Western European and Others Group	0	0

Sao Tome and Principe	African Group	0	0
Saudi Arabia	Asia-Pacific Group	8	1
Senegal	African Group	7	1
Serbia	Eastern European Group	8	1
Seychelles	African Group	7.5	1
Sierra Leone	African Group	7	1
Singapore	Asia-Pacific Group	9.5	4
Slovakia	Eastern European Group	5	0
Slovenia	Eastern European Group	6.5	1
Solomon Islands	Asia-Pacific Group	6.5	1
Somalia	African Group	7.5	0
South Africa	African Group	8.5	1
South Sudan	African Group	7	1
Spain	Western European and Others Group	7.5	4
Sri Lanka	Asia-Pacific Group	7.5	1
Sudan	African Group	0	0
Suriname	Latin American and Caribbean Group	0	0
Sweden	Western European and Others Group	9.5	4
Switzerland	Western European and Others Group	9	4
Syrian Arab Republic	Asia-Pacific Group	0	0
Tajikistan	Asia-Pacific Group	4.5	0
Thailand	Asia-Pacific Group	8	3
The former Yugoslav Republic of Macedonia	Eastern European Group	8	1
Timor-Leste	Asia-Pacific Group	9	2
Togo	African Group	0	0
Tonga	Asia-Pacific Group	4.5	0
Trinidad and Tobago	Latin American and Caribbean Group	7.5	1
Tunisia	African Group	8	1
Turkey	Western European and Others Group	6	1
Turkmenistan	Asia-Pacific Group	0	0
Tuvalu	Asia-Pacific Group	4	0
Uganda	African Group	7	1
Ukraine	Eastern European Group	8.5	4
United Arab Emirates	Asia-Pacific Group	7	1
United Kingdom of Great Britain and Northern Ireland	Western European and Others Group	10	5
United Republic of Tanzania	African Group	9	1
United States of America	Western European and Others Group	10	5

Uruguay	Latin American and Caribbean Group	8	4
Uzbekistan	Asia-Pacific Group	0	0
Vanuatu	Asia-Pacific Group	0	0
Venezuela, Bolivarian Republic of	Latin American and Caribbean Group	6	0
Viet Nam	Asia-Pacific Group	7	1
Yemen	Asia-Pacific Group	0	0
Zambia	African Group	8	0
Zimbabwe	African Group	0	0
Abkhazia	NONE	0	0
Artsakh	NONE	0	0
Cook Islands	NONE	9	1
Kosovo	NONE	9	1
Niue	NONE	0	0
Northern Cyprus	NONE	0	0
Sahrawi Arab Democratic Republic	NONE	0	0
Somaliland	NONE	0	0
South Ossetia	NONE	0	0
Taiwan (Republic of China; Chinese Taipei)	NONE	8.5	2
Transnistria	NONE	0	0
Hong Kong	With China	10	4

4.2 Independent variable: Foreign data

As basis for the independent variables of the regression analysis served nine data sets containing country relevant factors. These data sets originating from well-respected sources are commonly used and accepted to describe specific characteristics of a country.

- **Country/Area Size**
- **Population Size**
- **Human Development Index**
- **Gross Domestic Product (PPP) per Capita**
- **Gini-Index**
- **Ease of Doing Business Index**
- **Democracy Index**
- **Corruption Perceptions Index**
- **Political Stability Index**

4.2.1   Selection of factors

For the selection of the factors characterising the different countries, it was important that the following four categories are represent by the chosen data sets: geographic, economic, political and demographic attributes. This allocation is certainly not undisputed and may overlap to a certain degree. But here this classification only serves to ensure that the selected factors are meaningful and cover a broad spectrum of determinants.[14] In addition, for each factor always the most recent values available at the time of the evaluation were chosen. If a value was not available for the current year, its value of the most recent year was used for the evaluation.

4.2.1.1   Geographic factor

For the factor representing the geographical influence on e-procurement the following data sets were selected:

---

[14] The sources for the respective factors can be found in Appendix B of this work.

Country/Area size

This factor was included because for a procurement authority of a bigger country it could be more difficult to reach out to all the potential suppliers. And an e-procurement infrastructure that offers better service quality could counter this to some extent. No direct sources have been found to support this, although it is known that geographical factors, particularly distances, can influence the economy of a country (Boulhol, de Serres & Molnar, 2008).

4.2.1.2   Demographic factors

Another characteristic of a country is its demography. Two factors related to demography have been chosen.

Population size

A primary demographic factor is the population size of a country or an area. For this evaluation the population data of the United Nations for the year 2018 has been used. It appears plausible that a bigger population size leads to a higher density of businesses and could lead to more competition (Bucci, 2014). This could affect a country's e-procurement infrastructure.

Human Development Index

For the Human Development Index the situation is more complex as for the two factors mentioned before. The 2019 United Nations Development Programme's (UNDP) Human Development Report (p. 303) defines the Human Development Index as follows:

> "A composite index measuring average achievement in
> three basic dimensions of human development — a long
> and healthy life, knowledge and a decent standard of
> living."

Essentially, the index is a condensate of three demographic dimensions, namely life expectancy at birth, expected years of schooling and the gross national income per

capita. It is an indicator for the degree of human development around the world and an important political decision-making tool (UNDP, 2019, pp. 3-6).

4.2.1.3   Economic factors

Research by the World Bank (2018, p. 14) suggests that income and monetary aspects have an influence on public procurement, and thus also on public e-procurement Therefore, a focus was placed on factors affecting the economy of a country.

Gross Domestic Product (PPP) per Capita

With this knowledge it appears reasonable to include a factor representing the wealth or income class of a country. The GDP is already established as such a factor. The GDP per capita is the market value of all final goods and services produced within a country or area in a given period of time divided through the nation's population number during that time. The GDP per capita in purchasing power parity has been chosen to compare the different countries (Mankiw & Taylor, 2011, pp. 487-533).

Gini-Index

The Gini coefficient, the basis for the Gini-Index, is a measure of income inequality. It allows the comparison of income and wealth distribution across societies (Farris, 2010, pp. 851-852). The data used for this work is provided by the World Bank and measures the extent to which the distribution of income deviates from an equal distribution. A "Gini index of 0 represents perfect equality, while an index of 100 implies perfect inequality".[15]

Due to its nature, a negative correlation is expected. In other words it is assumed, that a lower income inequality leads to a higher service quality or a higher standard for access to data.

---

[15]   See   Dataset   GINI   Index   of   the   World   Bank,   available   at: https://data.worldbank.org/indicator/SI.POV.GINI, web access 11. November 2019.

Ease of Doing Business Index

The basis of the Ease of Doing Business Index provided by the World Bank is again a composition of different indicators with regard to the regulatory performance of an economy, called the ease of doing business score. It "measures an economy's performance with respect to a measure of regulatory best practice across the entire sample of 41 indicators for 10 Doing Business topics" (The World Bank, 2019, p. 78).

Not yet included in the 2019 data set are indicators with regards to "employing workers" and "contracting with the government". The respective economies performance with regards to doing business is reflected on a scale from 0, the lowest, to 100, representing the best performance (The World Bank, 2019, pp. 81 and 85).

4.2.1.4   Political factors

Economic success is often related to political decisions and governance; therefore, it makes sense to include factors representing political aspects into the evaluation as well.

Democracy Index

As an indicator for the degree of democratization, the Economist's 2019 (p. 3) Democracy Index has been chosen. The index on a 0 to 10 scale is based on the ratings for 60 indicators grouped into the following five categories (the Economist, 2019, p. 52).

- **Electoral process and pluralism**
- **Functioning of government**
- **Political participation**
- **Political culture**
- **Civil liberties**

Even if there is no consensus on how to measure the degree of democratisation, the measurement system used here is rather based on the question on how a democracy ideally should look like. This includes political freedom together with fair and

competitive elections, the peaceful transition of power and the freedom it grants to its citizens, the admission of participations and more aspects. The variety of social and economic outcomes of democracy is not considered within this scoring (the Economist, 2019, pp. 51-52).

Corruption Perceptions Index

As already stated (particularly in chapter 2), corruption and public procurement are closely connected. Increased transparency with regards to procurement can help to lower the danger of corruption. Therefore, a factor representing this issue must be included.

The most important measure regarding corruption and transparency is the Corruption Perceptions Index provided annually by Transparency International. It relies on surveys and expert assessments to measure public sector corruption on a scale from 0, highly corrupt, to 100, very clean government.[16]

Political Stability Index

The Political Stability Index data are also provided by the World Bank. It is part of their "Worldwide Governance Indicators" data sets and reflects an assessment of the likelihood that the government will be destabilized or overthrown by unconstitutional or violent means (Kaufmann, Kraay & Mastruzzi, 2011, p.223).
The index is based on numerous variables, including security risk ratings, evaluation of internal and external conflicts and ethnic tensions.[17]

The index has been selected to include the widely recognized fact that political stability and economic growth are deeply connected (Hussain, 2014). Hence, it is assumed that political stability may also affect a country's e-procurement infrastructure.

---

[16] See Dataset Corruption Perception Index 2018 of Transparency International, available at: https://www.transparency.org/cpi2018, web access 11. November 2019.

[17]   See   Documentation   Worldwide   Governance   Indicators,   available   at: https://info.worldbank.org/governance/wgi/Home/Documents#docReading, web access 21. February 2020.

4.2.2   Possible problems

With the selected variables, some problems occurred and will be discussed shortly in this section.

4.2.2.1   Factor composition and measurement

The majority of the chosen factors is based on a combination of criteria and indicators. Although for most sources explanatory materials and documentation are provided, it is very difficult to understand what has been measured, which methods have been used and how the factor is subsequently calculated. Especially within the limited framework of this thesis.

Furthermore, the source material and the way it has been measured for the integrated indicators could not be verified and examined for every factor.

However, many of the chosen factors form the basis for economic and political decisions by institutions and governments. Therefore, it was decided to include and evaluate them, even if some of them lack scientific standards.

4.2.2.2   Co-correlation

The variety of different indicators within the factors can lead to co-correlation among the independent variables. This could be problematic when conducting a regression analysis. For example, if the same indicator is used in two different factors, it influences the impact of both factors on the dependent variable. By calculating a correlation matrix and extracting the respective correlation between the individual factors, potential problematic cases of co-correlation can be detected. This has been carried out with the rcorr function of R-Studio. The following chart shows the Pearson's r or Spearman's rho rank correlation among the chosen factors.[18] Additionally, p-values have been calculated to show the significance of the correlation.

---

[18] See Documentation R, available at: https://www.rdocumentation.org/packages/Hmisc/versions/4.3-1/topics/rcorr, web access 21. February 2020.

Table 7: Correlations between the nine selected factors.

row	column	cor	p
Country	Population	0.451137885	8.984369e-12
Country	CPI	-0.003618830	9.615460e-01
Population	CPI	-0.038981540	6.033799e-01
Country	DemI	-0.014337621	8.545306e-01
Population	DemI	-0.012506782	8.729384e-01
CPI	DemI	0.761060341	0.000000e+00
Country	HDI	0.106632129	1.441826e-01
Population	HDI	-0.003480424	9.620903e-01
CPI	HDI	0.738051191	0.000000e+00
DemI	HDI	0.623147752	0.000000e+00
Country	PolStabI	-0.095659705	1.822923e-01
Population	PolStabI	-0.145448642	4.194293e-02
CPI	PolStabI	0.764171266	0.000000e+00
DemI	PolStabI	0.646808598	0.000000e+00
HDI	PolStabI	0.612346819	0.000000e+00
Country	GDPpC	0.058697527	4.031533e-01
Population	GDPpC	-0.036438866	6.039649e-01
CPI	GDPpC	0.738015739	0.000000e+00
DemI	GDPpC	0.470701180	1.558962e-10
HDI	GDPpC	0.746209775	0.000000e+00
PolStabI	GDPpC	0.529389008	1.332268e-15
Country	GINI	0.049801868	5.278272e-01
Population	GINI	-0.006222266	9.371679e-01
CPI	GINI	-0.302820452	1.218254e-04
DemI	GINI	-0.164162944	4.618023e-02
HDI	GINI	-0.352984819	4.375653e-06
PolStabI	GINI	-0.154708443	4.862411e-02
GDPpC	GINI	-0.375329580	7.945462e-07
Country	EoDB	0.116567003	1.101876e-01
Population	EoDB	0.082137418	2.611779e-01
CPI	EoDB	0.729603476	0.000000e+00
DemI	EoDB	0.631599277	0.000000e+00
HDI	EoDB	0.762781538	0.000000e+00
PolStabI	EoDB	0.560617147	0.000000e+00
GDPpC	EoDB	0.573581084	0.000000e+00
GINI	EoDB	-0.345496274	7.165592e-06

Country = Country/Area Size;   EoDB = Ease of Doing Business Index;
Population = Population Size;   DemI = Democracy Index;
HDI = Human Development Index;   CPI = Corruption Perceptions Index;
GDPpC = Gross Domestic Product (PPP) per Capita;   PolStabI = Political Stability Index
GINI = Gini-Index;

According to Frost (2019), multicollinearity is not necessarily a problem, but it can lead to unstable coefficient estimates based on which other independent variables in the model are selected. This makes the coefficients very sensitive to small changes in the model. Additionally, it reduces the precision of the estimated coefficients, which weakens the statistical power of the regression model.

Through the already mentioned interdependencies among the chosen factors, a wide range of co-correlation among some of them is expected. To address the danger of order dependent unstable coefficient estimates as mentioned by Frost, different order

variations have been evaluated by conducting the regression analysis. However, no such problems could be found.

The second issue regarding a reduced precision is considered less problematic, as this work aims only at identifying the factors with the strongest effect, and not the strength of their effect.

Nevertheless, the following table shows the relationship that must be considered when conducting the regression and interpreting the results.

Table 8: Co-correlation to be considered.

row	column	cor	p
Country	Population	0.451137885	8.984369e-12
CPI	DemI	0.761060341	0.000000e+00
CPI	HDI	0.738051191	0.000000e+00
DemI	HDI	0.623147752	0.000000e+00
CPI	PolStabI	0.764171266	0.000000e+00
DemI	PolStabI	0.646808598	0.000000e+00
HDI	PolStabI	0.612346819	0.000000e+00
CPI	GDPpC	0.738015739	0.000000e+00
DemI	GDPpC	0.470701180	1.558962e-10
PolStabI	GDPpC	0.529389008	1.332268e-15
CPI	GINI	-0.302820452	1.218254e-04
DemI	GINI	-0.164162944	4.618023e-02
HDI	GINI	-0.352984819	4.375653e-06
PolStabI	GINI	-0.154708443	4.862411e-02
GDPpC	GINI	-0.375329580	7.945462e-07
CPI	EoDB	0.729603476	0.000000e+00
DemI	EoDB	0.631599277	0.000000e+00
HDI	EoDB	0.762781538	0.000000e+00
PolStabI	EoDB	0.560617147	0.000000e+00
GDPpC	EoDB	0.573581084	0.000000e+00
GINI	EoDB	-0.345496274	7.165592e-06

Country = Country/Area Size;   EoDB = Ease of Doing Business Index;
Population = Population Size;   DemI = Democracy Index;
HDI = Human Development Index;   CPI = Corruption Perceptions Index;
GDPpC = Gross Domestic Product (PPP) per Capita;   PolStabI = Political Stability Index
GINI = Gini-Index;

5 Statistical analysis and results

First this section provides a brief overview of the nature of the dependent variable. This is followed by a suitable regression method to determine the impact of the independent variables on the results obtained by the evaluation of the e-procurement portals for "Service Quality" and "Data Access".

5.1 Statistical overview: How do the dependent variables look like?

As shown above, for 154 of the 207 examined countries or areas an e-procurement infrastructure could be found.

The overall distribution of scores with regards to "Service Quality" is as follows.

Distribution of Service Quality

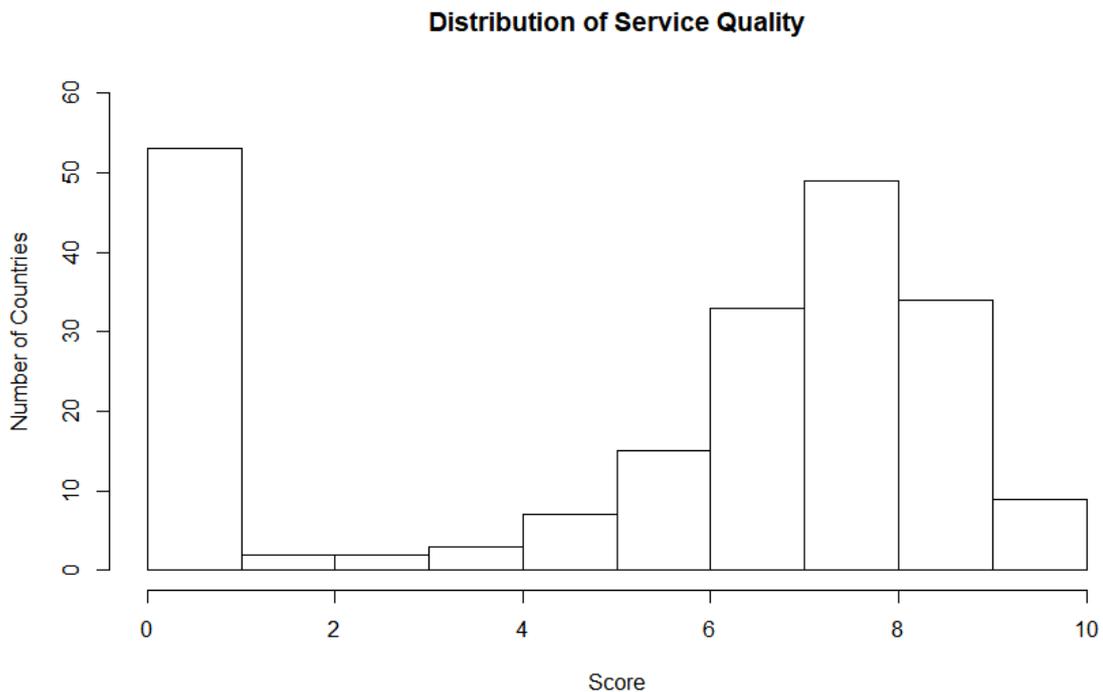*Figure 18: Distribution of the total score for "Service Quality" of all 207 examined countries and areas. The score for those without an e-procurement infrastructure was set to 0.*

The total score for "Service Quality" ranges from 0 to 10. Excluding the 53 countries or areas without an e-procurement infrastructure the distribution of the remaining 154 is skewed to the right with a median of 7.5.
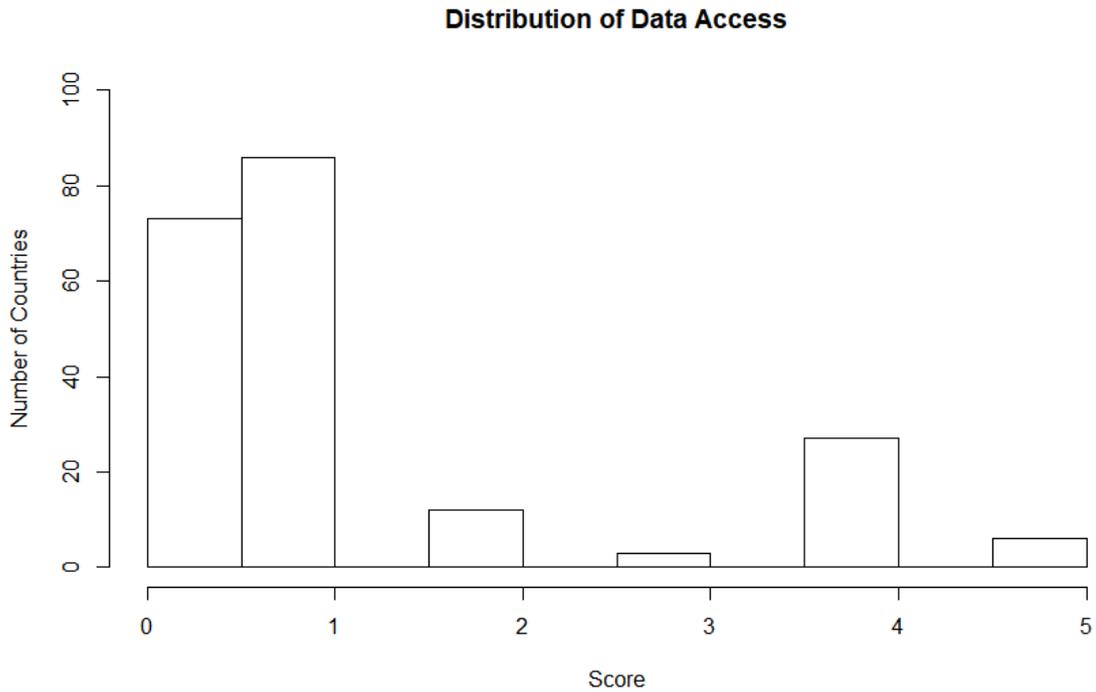
Figure 19: Distribution of the total score for "Data Access" of all 207 examined countries and areas. The score for those without an e-procurement infrastructure was set to 0.

The total score for "Data Access" ranges from 0 to 5. The distribution is almost bimodal, with a maximum at 0 to 1, and another at 4 points. This results in a mean of 1.

As already mentioned, the scale for both variables is ordinal. Therefore the increase in "Service Quality" respective "Data Access" by an additional point is undetermined and not uniform (Field, Miles & Field; 2012, p. 10).

5.2 Regression analysis

To determine the impact of the selected independent variables on the dependent variables, a regression method suitable for the data had to be determined.

5.2.1 Regression method

The recommended regression method to investigate the influence of several factors on a dependent ordinally scaled variable is the ordered logistic regression (Field, Miles & Field; 2012, p. 313). This multiple regression analysis yields a coefficient

that predicts how a given set of independent variables influences the outcome category of a dependent variable under investigation. This means, the coefficient predicts how the value of a dependent variable alters if the independent variable changes its value (Field, Miles & Field; 2012, p. 313). The outcome category of the dependent variables "Service Quality" and "Data Access" is determined by their respective score. The cut-points for defining said categories are set by the R software.

The output of the regression model for each factor (independent variable) will be a regression coefficient (Value), the standard error (Std. Error) and the t-value. Further, to determine the significance level of each coefficient a p-value will be calculated and added to the output table. This will be done by comparing the t-value with the standard normal distribution, similar to a z-test. Even though this only applies with infinite degrees of freedom, it is reasonably approximated by large samples (UCLA 2016).

The independent variables have been standardized before conducting the regression analysis. The calculations were conducted with the RStudio statistic software.[19]

5.2.2 Analysis procedure

To investigate various aspects of the impact of the chosen factors on "Service Quality" and "Data Access" a series of different regressions will be conducted for each dependent variable.

First, the impact of all collected data on each individual dependent variable will be examined. Therefore, countries or areas not providing any form of e-procurement infrastructure will be still included.

In a second step, countries and areas, which are not providing any e-procurement infrastructure will be excluded from the datasets.

The last step will be to include "Service Quality" as independent variable into the evaluation of "Data Access". This is based on the assumption that a better

---

[19] RStudio, Version 1.2.5033.

infrastructure not only increases the service quality of a portal, but also makes it easier for procurement authorities to provide better access to data.

Possible differences regarding the impact of different factors in those scenarios will be discussed in chapter 6.

5.2.3   Results: Regression analysis

The following section will present the results of the conducted ordered logistic regression analysis together with the different steps performed.

The strength of the influence of each independent variable is evaluated by comparing the regression coefficients and p-values.

The cut-points used by the R software to delimit adjacent outcome categories of "Service Quality" and "Data Access" are marked in grey and presented in the tables alongside the results for a complete presentation of the performed analyses.

5.2.3.1   Result: Service quality

First, the influence of the impact factors on "Service Quality" was evaluated across all the examined countries and areas.

Table 9: Influence of the independent variables on "Service Quality" across all countries and areas.

	Value	Std. Error	t value	p value
Country	0.43419124	0.1707492	2.5428596	1.099494e-02*
Population	-0.16167744	0.1300028	-1.2436457	2.136300e-01
CPI	-0.05053150	0.3871256	-0.1305300	8.961471e-01
DemI	1.45404034	0.3339514	4.3540482	1.336463e-05***
HDI	-0.39696252	0.3194253	-1.2427399	2.139637e-01
PolStabI	-0.03974615	0.2874787	-0.1382577	8.900368e-01
GDPpC	-0.49555829	0.4123440	-1.2018081	2.294379e-01
GINI	-0.27168821	0.1792025	-1.5160964	1.294950e-01
EoDB	1.09519611	0.3068337	3.5693481	3.578707e-04***
0|1.5	-1.86871611	0.2720951	-6.8678789	6.516352e-12
1.5|2	-1.80353057	0.2684919	-6.7172616	1.851714e-11
2|3	-1.74021355	0.2651545	-6.5630178	5.272955e-11
3|3.5	-1.67902581	0.2620626	-6.4069638	1.484460e-10
3.5|4	-1.56443100	0.2566182	-6.0963373	1.085263e-09
4|4.5	-1.56443088	0.2566182	-6.0963368	1.085266e-09
4.5|5	-1.45575714	0.2518285	-5.7807477	7.436934e-09
5|5.5	-1.34923219	0.2471608	-5.4589244	4.790277e-08
5.5|6	-1.13342386	0.2384059	-4.7541761	1.992573e-06
6|6.5	-0.67297961	0.2241926	-3.0017925	2.683951e-03
6.5|7	-0.39462847	0.2181814	-1.8087173	7.049494e-02
7|7.5	0.57603471	0.2178119	2.6446425	8.177727e-03
7.5|8	1.01731062	0.2264021	4.4933789	7.010190e-06
8|8.5	2.15239281	0.2648559	8.1266555	4.412973e-16
8.5|9	2.80170942	0.3022622	9.2691346	1.876624e-20

```
9|9.5        4.20348905  0.4558391  9.2214321 2.931582e-20
9.5|10       4.95835434  0.5922356  8.3722667 5.652036e-17
```

***P<0.001, **P<0.01, *P<0.05

Country = Country/Area Size;   EoDB = Ease of Doing Business Index;
Population = Population Size;   DemI = Democracy Index;
HDI = Human Development Index;   CPI = Corruption Perceptions Index;
GDPpC = Gross Domestic Product (PPP) per Capita;   PolStabI = Political Stability Index
GINI = Gini-Index;

The data suggest that Grade of Democracy and Ease of Doing Business have the strongest effect, and Country/Area Size a less pronounced impact on "Service Quality".

To eliminate factors that could influence whether a country or area provides an e-procurement infrastructure, those countries that do not providing one (non-providers) were excluded from the data set for the next evaluation. This way, the influence of the factors purely on the "Service Quality" of actually provided infrastructure was examined.

Table 10: Influence of the independent variables on "Service Quality" excluding data for "non-providers".

```
               Value Std. Error    t value      p value
Country     0.4178287  0.1638899  2.5494468 1.078940e-02*
Population -0.2125561  0.1293446 -1.6433313 1.003144e-01
CPI         0.0555030  0.4124261  0.1345768 8.929465e-01
DemI        1.6087801  0.3860815  4.1669438 3.087105e-05***
HDI        -0.5597830  0.3470955 -1.6127636 1.067959e-01
PolStabI   -0.1913114  0.3378299 -0.5662951 5.711932e-01
GDPpC      -0.4089950  0.4450220 -0.9190445 3.580723e-01
GINI       -0.1638389  0.1903601 -0.8606792 3.894148e-01
EoDB        0.7989067  0.3200775  2.4959788 1.256101e-02*
1.5|2      -4.9732699  1.0226375 -4.8631796 1.155150e-06
2|3        -4.2678415  0.7386895 -5.7775855 7.578020e-09
3|3.5      -3.8513277  0.6158914 -6.2532577 4.019780e-10
3.5|4      -3.3227852  0.4964934 -6.6925063 2.193803e-11
4|4.5      -3.3227841  0.4964932 -6.6925069 2.193794e-11
4.5|5      -2.9542885  0.4341928 -6.8040931 1.016878e-11
5|5.5      -2.6525759  0.3921168 -6.7647605 1.335299e-11
5.5|6      -2.1568070  0.3382946 -6.3755292 1.823322e-10
6|6.5      -1.3334487  0.2775859 -4.8037331 1.557344e-06
6.5|7      -0.9146122  0.2572647 -3.5551404 3.777773e-04
7|7.5       0.2772883  0.2409211  1.1509508 2.497525e-01
7.5|8       0.7498994  0.2475061  3.0298218 2.446981e-03
8|8.5       1.9220681  0.2835684  6.7781459 1.217279e-11
8.5|9       2.5779067  0.3186152  8.0909707 5.919109e-16
9|9.5       3.9599422  0.4659446  8.4987402 1.916593e-17
9.5|10      4.6967532  0.5987958  7.8436637 4.375879e-15
```

***P<0.001, **P<0.01, *P<0.05

Country = Country/Area Size;   EoDB = Ease of Doing Business Index;

Population = Population Size;   DemI = Democracy Index;
HDI = Human Development Index;   CPI = Corruption Perceptions Index;
GDPpC = Gross Domestic Product (PPP) per Capita; PolStabI = Political Stability Index
GINI = Gini-Index;

In this analysis the Grade of Democracy shows a strong impact on "Service Quality". Further, the effect of Ease of Doing Business is reduced compared to the previous analysis, while the strength of the impact of the Country/Area Size remains about the same.

5.2.3.2   Result: Data access

A similar approach was chosen to evaluate the "Data Access" provided by an e-procurement infrastructure.

First, the ordered logistic regression analysis was carried out with the data set including all the examined countries and areas.

Table 11: Influence of the independent variables on "Data Access" across all countries and areas.

	Value	Std. Error	t value	p value
Country	0.61330623	0.1827844	3.3553531	7.926375e-04***
Population	-0.18124313	0.1562579	-1.1598971	2.460907e-01
CPI	0.03103797	0.4295871	0.0722507	9.424024e-01
DemI	1.81684454	0.3878641	4.6842302	2.810141e-06***
HDI	0.27899965	0.3723469	0.7493003	4.536762e-01
PolStabI	-0.33173114	0.3167068	-1.0474394	2.948970e-01
GDPpC	-0.88544187	0.4901141	-1.8066034	7.082414e-02
GINI	-0.45365949	0.2056352	-2.2061373	2.737439e-02*
EoDB	0.94085323	0.3427766	2.7448004	6.054772e-03**
0|1	-1.27713591	0.2702173	-4.7263291	2.286150e-06
1|2	2.01717936	0.3065844	6.5795249	4.719540e-11
2|3	2.62312602	0.3296652	7.9569402	1.763459e-15
3|4	2.80589102	0.3382448	8.2954450	1.081795e-16
4|5	5.19476114	0.5801638	8.9539567	3.429633e-19

***P<0.001, **P<0.01, *P<0.05

Country = Country/Area Size;   EoDB = Ease of Doing Business Index;
Population = Population Size;   DemI = Democracy Index;
HDI = Human Development Index;   CPI = Corruption Perceptions Index;
GDPpC = Gross Domestic Product (PPP) per Capita; PolStabI = Political Stability Index
GINI = Gini-Index;

The data suggest a strong impact of both Grade of Democracy and Country/Area Size, whereas Ease of Doing Business seems to have a medium impact and the Gini coefficient a smaller one.

As before for "Service Quality", the countries not providing an e-procurement infrastructure (non-providers) were excluded from the data set for an additional evaluation.

Table 12: Influence of the independent variables on "Data Access" excluding data for "non-providers".

	Value	Std. Error	t value	p value
Country	0.6187686	0.1802521	3.4327959	5.973917e-04***
Population	-0.2526450	0.1669918	-1.5129189	1.303003e-01
CPI	0.2159417	0.4613287	0.4680863	6.397229e-01
DemI	2.0462752	0.4770939	4.2890407	1.794465e-05***
HDI	0.4711926	0.4243856	1.1102937	2.668725e-01
PolStabI	-0.8463324	0.3997627	-2.1170868	3.425248e-02*
GDPpC	-0.9100383	0.5375076	-1.6930706	9.044202e-02
GINI	-0.3559261	0.2291186	-1.5534578	1.203138e-01
EoDB	0.6223097	0.3696931	1.6833142	9.231428e-02
0|1	-2.1516913	0.3640192	-5.9109282	3.401852e-09
1|2	1.8977536	0.3510153	5.4064689	6.427937e-08
2|3	2.5242582	0.3736271	6.7560903	1.417651e-11
3|4	2.7136667	0.3824049	7.0963170	1.281254e-12
4|5	5.1602263	0.6228230	8.2852213	1.178897e-16

***P<0.001, **P<0.01, *P<0.05

Country = Country/Area Size;	EoDB = Ease of Doing Business Index;
Population = Population Size;	DemI = Democracy Index;
HDI = Human Development Index;	CPI = Corruption Perceptions Index;
GDPpC = Gross Domestic Product (PPP) per Capita;	PolStabI = Political Stability Index
GINI = Gini-Index;	

Again, the data indicate a strong impact of both the Grade of Democracy and Country/Area Size, while the Ease of Doing Business and the Gini coefficient have no significant impact on the "Data Access" of an already existing e-procurement infrastructure. Political Stability, however, seems to have more impact if only the already existing infrastructures are examined.

Beside the nine factors selected as independent variables, there is a tenth factor that can be expected to affect "Data Access". A high "Service Quality" or quality of an e-procurement infrastructure in general, can facilitate the data provision and thus contribute to improving the standard by which data is provided. Therefore "Service Quality" was introduced as the tenth factor examined.

The following table contains the results of an ordered logistic regression using only the data from the nations providing an e-procurement portal and including "Service Quality" as a tenth factor.

Table 13: Influence of the independent variables including "Service Quality" on "Data Access"
excluding data for "non-providers".

```
                 Value  Std. Error    t value        p value
Service_Quality 4.9537050  0.8309345   5.9616073  2.497688e-09***
Country         0.4942369  0.1872134   2.6399649  8.291460e-03**
Population      -0.2057566  0.1778886  -1.1566599  2.474113e-01
CPI             0.4874699  0.5079654   0.9596517  3.372306e-01
DemI            1.3341883  0.5508517   2.4220461  1.543339e-02*
HDI             1.1830167  0.5256266   2.2506791  2.440587e-02*
PolStabI       -1.0394337  0.4377878  -2.3742867  1.758289e-02*
GDPpC          -1.0123930  0.6615474  -1.5303408  1.259324e-01
GINI           -0.2346450  0.2547280  -0.9211588  3.569675e-01
EoDB            0.1617009  0.3994825   0.4047758  6.856423e-01
0|1            -0.8241824  0.4663230  -1.7674066  7.716016e-02
1|2             4.8156278  0.7198839   6.6894506  2.240100e-11
2|3             5.6525781  0.7664618   7.3748984  1.644705e-13
3|4             5.9174470  0.7844787   7.5431581  4.587245e-14
4|5             9.2204302  1.1268796   8.1822672  2.785526e-16
```

***P<0.001, **P<0.01, *P<0.05

Country = Country/Area Size;	EoDB = Ease of Doing Business Index;
Population = Population Size;	DemI = Democracy Index;
HDI = Human Development Index;	CPI = Corruption Perceptions Index;
GDPpC = Gross Domestic Product (PPP) per Capita;	PolStabI = Political Stability Index
GINI = Gini-Index;	

With the introduction of a new variable, a shift of the regression coefficients is expected. In this amended analysis, it appears that the service quality has a strong impact on "Data Access". While the impact of Country/Area Size and Political Stability has remained approximately the same, the impact of Grade of Democracy has decreased massively, but remains significant. In addition, the factor Human Development appears to exert a significant influence as well.

5.3 Summary analysis

The following table summarizes the factors which, based on the data, could impact "Service Quality" and "Data Access" of an e-procurement infrastructure. The results are presented sorted according to the different regression procedures. Each factor was selected based on its regression coefficient (the higher the value, the stronger its impact) and its p-value (statistical significance).

Although strong co-correlations between some of the factors have been identified previously, no difficulties have been observed with regard to this potential problem when conducting the regressions.

Table 14: Overview of the impact of the identified factors.

Dependent Variable	Regression Parameters							
	All		**Without non-providers**		**Without non-provider, plus tenth factor**			
"Service Quality"	DemI	+++	DemI	+++		
	EoDB	+++	Country	+		
	Country	+	EoDB	+		
"Data Access"	DemI	+++	DemI	+++	SQ	+++
	Country	+++	Country	+++	Country	++
	EoDB	++	PolStabI	+	DemI	+
	GINI	+			PolStabI	+
					HDI	+
Country = Country/Area Size; HDI = Human Development Index; GINI = Gini-Index;			EoDB = Ease of Doing Business Index; DemI = Democracy Index; PolStabI = Political Stability Index					

6 Conclusions

6.1 Summary

After elaborating the key terms relating to public procurement with a focus on e-procurement, and a closer examination of the process of an e-procurement system, the global e-procurement infrastructure was recorded on a country level. Based on recent literature and information portal research, a framework to evaluate said infrastructures was developed and applied to the recorded e-procurement infrastructure data.

After that a set of nine factors potentially having an impact on "Service Quality" and "Data Access" was identified. Using an ordered logistic regression, the factors were tested and a set of factors influencing the "Service Quality" and "Data Access" of an e-procurement infrastructure were identified.

6.2 Findings and implications

The discussion of the results is split into two parts. First, the focus lies on the findings from the data recording and country/area evaluation, then the results of the regression analysis will be discussed.

6.2.1 Findings of the e-procurement infrastructure evaluation

By recording and analysing the global e-procurement infrastructures on a country level, valuable insights could be gained. The research questions 1-3 are best answered in detail by the data gathered in this work. It can be found in Appendix A and chapter 4. Here some general observations will be discussed.

1) How does the e-procurement infrastructure look like on each country level?

Out of 207 inspected countries and areas, for 154 an e-procurement infrastructure on country level could be found, whereas 53 do not seem to have such an infrastructure. While gathering the data, it was noticed that very small countries or islands tend to use infrastructures on a higher level. Such an example is Andorra, which is using a rudimentary digital form of its official bulletin for tendering. Further, indications were found that the e-procurement portal of Catalonia is used as well. Another example are the Federal States of Micronesia. There an official e-procurement portal could not be found, but it seems like Micronesia is using an infrastructure on a super-ordinated level (Pacific Community).

In general, small states and especially islands tend to have only rudimentary e-procurement infrastructures if any at all. This might be related to the spatial distance from other markets and nations, or it is simply not seen as necessary. Many of these states provide an investment portal instead of an e-procurement infrastructure. However, this could be problematic in terms of corruption.

Another unexpected discovery was the dynamic nature of the public procurement landscape. While recording the data, it was observed that countries often change their infrastructure. Unfortunately, this often happened over a short period of time without any transitional solution or appropriate announcement. For example, by the time the data had been recorded, the Nigerian portal was no longer reachable. Now they initiated a new infrastructure with the help of the Open Contracting Partnership.

Another example are the United States of America. There an announcement was made and the transition was well planned, but the new infrastructure went online after the due date of the data collection of this work.

The third and last observation worth mentioning here is the impact of institutions like the Open Contracting Partnership. Many good examples have been found, such as Afghanistan, Colombia, Ukraine and now, as mentioned above, Nigeria. They scored well in terms of both "Service Quality" and "Data Access".

2) What is the service quality level in each country?

As seen in chapter 4 and the data description in chapter 5, the average score for "Service Quality" across all the evaluated countries and areas is 5.5, with a median of 7. If only the countries and areas providing an e-procurement infrastructure are included, the average score is 7.39 and the median 7.5.

The biggest obstacle still seems to be the language barrier, as RAMBOLL/HTW Huhr already mentioned in 2011 (pp. 79-80). Only two-thirds of the countries with an infrastructure offer English on their portal. English tenders are only offered by one-third of them.

An other problem is multiple portals for the same country or area. This makes the e-procurement infrastructure in Germany or Austria for example unnecessarily complicated. A single point of access is considered as best practice (European Bank for Reconstruction and Development, 2015, pp. 46-49). The reason behind the fragmented e-procurement landscape of the above-mentioned nations in particular, as well as others, could be based on historical development. Nevertheless, this should absolutely be changed soon.

3) How does the level of access to data for each country look like?

As mentioned before a detailed description of the data can be found in chapter 4 and Appendix A. The average score for "Data Access" across all nations is 1.24, with a median of 1. Excluding the nations without an e-procurement infrastructure, the average is 1.66, with a median of 1.

By applying the customized framework based on the Open Contracting Data Standard, a gap in the assigned scores between 1 and 4 can be observed (see Figure 19). This is probably due to the fact that the leap from providing data in a simple file to providing it through an API is easier to implement than a series of minor incremental improvements of the data standard. This leap can be achieved by a system upgrade and is probably more rewarding on the long run.

It was noticed that some nations (e.g. Malaysia, the United Arab Emirates), despite having a good infrastructure and having provided procurement data in the past,

ceased the periodical release of procurement data after a promising initial phase. This clearly poses a problem, particularly regarding corruption and the principle of transparency. At this point one can only speculate about the reasons behind this. It could involve insufficient training of employees or faulty processes. Whatever the reasons may be, it is important that once standards have been implemented, they should not be lowered.

6.2.2   Findings of the regression analysis

To answer the fourth research question, a series of regression analysis have been conducted.

4) Which factors distinguish countries with a higher level of service quality from those with a lower level?

By examining all the countries and areas recorded with regard to the fourth research question, the following impact factors and impact strength (indicated by the number of + signs) could be identified.

- **Grade of Democracy**   +++
- **Ease of Doing Business**   +++
- **Country/Area Size**   +

To minimize the influence of factors potentially affecting whether or not an infrastructure is provided, all countries and areas not providing one were excluded in a next step. The significant factors identified in the analysis involving all the countries and areas remained the same. Only the factor Ease of Doing Business lost some of its impact.

- **Grade of Democracy**   +++
- **Ease of Doing Business**   +
- **Country/Area Size**   +

It is somewhat surprising that monetary parameters like the Gross Domestic Product (PPP) per Capita seem to have no significant impact on the service quality.

Especially after the World Bank (2018, p. 14) found that income or monetary aspects have an impact on public procurement and thus on public e-procurement. However, their analysis focused more on the technical and legal aspects of public procurement. It appears therefore plausible that the implementation of a more sophisticated system and processes are rather related to monetary factors.

The data suggests that the main impact factor on "Service Quality", is the Grade of Democracy of a country. This appears plausible, especially considering that the factor used includes the category "Political participation" and thus the participation of interest groups and institutions. Involving different representatives, in particular economic and data experts, in designing and implementing procurement rules and standards seems to improve the service quality.

5) **Which factors distinguish countries with a higher level of access to data from those with a lower level?**

To answer this last research question, three different regression analyses were conducted.

First, all countries surveyed were included (left), then, as before for "Service Quality" the countries not providing an infrastructure were excluded in a next step (right).

- **Grade of Democracy**   +++
- **Country/Area Size**   +++
- **Ease of Doing Business**   ++
- **Income Distribution (Gini)** +

- **Grade of Democracy**   +++
- **Country/Area Size**   +++
- **Grade of Political Stability** +

Similar to "Service Quality", the data suggests that the main impact factor is again the Grade of Democracy of a country or area. This is probably due to the circumstance that the principle of transparency is an important part of both modern democracies as well as of public procurement.

A little surprising is the big impact of the Country/Area Size. This could be due to increased international pressures for transparency that bigger nations and markets are exposed to.

Finally, it was tested whether a better service quality of the e-procurement infrastructure has an impact on "Data Access". And indeed, the data suggest a very strong impact. This was expected. A better e-procurement system likely facilitates the process of making procurement data accessible to the public.

- **Grade of Service Quality**   +++
- **Country/Area Size**   ++
- **Grade of Democracy**   +
- **Grade of Political Stability**   +
- **Grade of Human Development**   +

Interestingly, the impact of the Grade of Democracy decreased when the Grade of Service Quality was added. As seen before, the Grade of Democracy has a strong impact on the Grade of Service Quality. The latter is probably better suited to explain "Data Access" than the Grade of Democracy.

6.3 Limitations and suggestions for further research

The approach to review the portals from an external perspective and thus the associated superficial analysis of the infrastructures, together with the not clearly distinguishable and composite factors used as independent variables, will probably reduce the scientific relevance of this work. Also, only a limited number of factors could be included in the evaluation.

Nevertheless, the global e-procurement landscape on a country level was recorded, and country specific impact factors were identified.

A future in-depth evaluation of the criteria and indicators forming the identified impact factors, in particular the Grade of Democracy, with regard to their effects on the quality and implementation of e-procurement would be valuable. This, combined with a further examination of factors not included in this work, could provide a deeper understanding of which country-related factors affect global e-procurement infrastructures.

It is also not clear how international e-procurement portals are linked to each other and to infrastructures at a higher or lower level. Can the existence of an

e-procurement portal at a higher level reduce the infrastructure offered at country level?

A periodical recording and the creation of a unified index, similar to the factors used in this work, to evaluate the global e-procurement infrastructure can provide further insights and allow a comparison over time.

Appendix A

See separate file.

Appendix B

Sources of the Independent Variables

The data has been accessed on the 9th of November 2019.

Geographic	
Country Size	https://www.cia.gov/library/publications/the-world-factbook/rankorder/2147rank.html https://unstats.un.org/unsd/demographic-social/products/dyb/dyb_2017/
Demographic	
Population Size	https://population.un.org/wpp/Download/Standard/Population/
Human Development Index	http://hdr.undp.org/en/data
Economic	
GDP per Capita	https://www.imf.org/external/datamapper/PPPPC@WEO/OEMDC/ADVEC/WEOWORLD https://www.cia.gov/library/publications/the-world-factbook/rankorder/2004rank.html http://documents.worldbank.org/curated/en/644671486531571103/pdf/Somalia-SJPER-01302017-Final-Version.pdf https://web.archive.org/web/20130616004647/http://www.vspmr.org/Upload/File/doklad2007.rar
Gini-Coefficient	https://data.worldbank.org/indicator/SI.POV.GINI
Ease of Doing Business	https://www.doingbusiness.org/en/data/doing-business-score
Political	
Democracy Index	https://www.eiu.com/public/topical_report.aspx?campaignid=democracy2018
Corruption Perception Index	https://www.transparency.org/cpi2018
Political Stability Index	https://info.worldbank.org/governance/wgi/

List of Figures

List of Tables

List of Abbreviations

API   *Application Programming Interface*

PPP *Procuring Infrastructure Public-Private Partnership*

References

Boulhol, H., de Serres, A. & Molnar, M. (2008). "The Contribution of Economic Geography to GDP per Capita". OECD Journal: Economic Studies, Volume 2008. 2008. Available at: https://www.oecd.org/norway/42506177.pdf, web access 13. February 2020.

Bravo Martín, S. & García-Peñalvo, F. J. (2013). *Electronic Government Systems for e-Procurement Procedure in the EU. In:* Ordóñez de Pablos, P., Cueva Lovelle, J. M., Labra Gayo, J. E., & Tennyson, D. R. (Eds.), *E-Procurement Management for Successful Electronic Government Systems*, IGI Global, 2013 (pages 29-51). https://doi.org/10.4018/978-1-4666-2119-0.

British Council (2013). THE ENGLISH EFFECT - The impact of English, what it's worth to the UK and why it matters to the world. Available at: https://www.britishcouncil.org/sites/default/files/english-effect-report-v2.pdf.

Bucci, A. (2014). "Population, Competition, Innovation, and Economic Growth with and without Human Capital Investment". *International Review of Economics* 61, no. 1 (April 2014): 61–84. https://doi.org/10.1007/s12232-013-0192-2.

Cernat, L. & Kutlina-Dimitrova, Z. (2015). "International public procurement: From scant facts to hard data", *DG TRADE Chief Economist Notes* 2015-1, Directorate General for Trade, European Commission.

Cribby, R., (2019). "Continents of the World." WorldAtlas. Available at: www.worldatlas.com/continents.html, last update: 17. July 2017, web access 12. January 2020.

Delone, W. H. & McLean, E. R. (2003). 'The DeLone and McLean Model of Information Systems Success: A Ten-Year Update'. *Journal of Management Information Systems* 19, no. 4 (April 2003): 9–30. https://doi.org/10.1080/07421222.2003.11045748.

Dooley, K. & Purchase, S. (2006) 'Factors Influencing E- Procurement Usage'. *Journal of Public Procurement* 6, no. 1/2 (March 2006): 28–45. https://doi.org/10.1108/JOPP-06-01-02-2006-B002.

Farris, F. A. (2010). 'The Gini Index and Measures of Inequality'. *The American Mathematical Monthly* 117, no. 10 (2010): 851. https://doi.org/10.4169/000298910x523344.

FDFA, (2016). Procurement guideline for FDFA contractors, Version 1.1 (April 2016). Federal Department of Foreign Affairs (FDFA), General Secretariat Competence Centre for Contracts and Procurement. Available at: https://www.eda.admin.ch/dam/eda/en/documents/dienstleistungen-publikationen/guideline_beschaffungs_Beauftragte_des_eda_en.pdf.

FDF, (2012). Administrativuntersuchung Beschaffungsprozesse INSIEME. Federal Department of Finance. 13. June 2012, Available at: www.newsd.admin.ch/newsd/message/attachments/35781.pdf.

Field, A. P., Miles, J. & Field Z. (2012). *Discovering Statistics Using R*. London; Thousand Oaks, Calif: Sage, 2012.

Frost, J. (2019). Multicollinearity in Regression Analysis: Problems, Detection, and Solutions Available at: https://statisticsbyjim.com/regression/multicollinearity-in-regression-analysis/, last update: Unknown, web access 24. February 2020.

The Economist (2019). Democracy Index 2019. A year of democratic setbacks and popular protest. A report by The Economist Intelligence Unit. Available at: https://www.eiu.com/public/topical_report.aspx?campaignid=democracy2018#.

Elodie, B. & Organisation for Economic Co-operation and Development (OECD), (2009). eds. *OECD Principles for Integrity in Public Procurement*. Paris: OECD, 2009.

European Bank for Reconstruction and Development (2015). Are you ready for eProcurement? Guide to Electronic Procurement Reform, Available at: http://ec.europa.eu/docsroom/documents/26423.

Evenett, S. J. & Hoekman, B. M. (2005). Government procurement: market access, transparency, and multilateral trade rules, *European Journal of Political Economy*, Vol. 21, 2005, pp. 163-183.

EXEP Subgroup Certification (2017). Certification of e-Tendering Platforms. EXEP subgroup report. Available at: http://ec.europa.eu/docsroom/documents/26423, last update: 10. November 2017, web access 18. November 2019.

Gebauer, J., Beam, C. & Segev, A. (1998). Impact of The Internet on Procurement. *Acquisition Review Quarterly*, Volume 5—Spring 1998, 167-184.

Hussain, Z. (2014). Can political stability hurt economic growth? Available at: https://blogs.worldbank.org/endpovertyinsouthasia/can-political-stability-hurt-economic-growth, last update: 1. June 2014, web access 21. February 2020.

Kaufmann, D., Kraay, A. & Mastruzzi, M. (2011). The Worldwide Governance Indicators: Methodology and Analytical Issues. *Hague Journal on the Rule of Law*, 3, pp 220-246, doi:10.1017/S1876404511200046

Konkurrensverket (2018), Basic principles for public procurement. Available at: www.konkurrensverket.se/en/publicprocurement/about-the-legislation/basic-principles-for-public-procurement/, web access 6. January 2020.

Kutlina-Dimitrova, Z. (2018). Government procurement: Data, trends and protectionist tendencies, *DG TRADE Chief Economist Notes* 2018-3, Directorate General for Trade, European Commission.

Lebaube P. (2002). The barriers and challenges for successful public e-procurement, An interview with Mr. Philippe Lebaube, Head of Unit at the Office for Official Publications of the European Commission. Available at:

http://ec.europa.eu/idabc/en/document/561/5589.html, web access 18. November 2019.

Lloyd, R. E. & McCue, C. P. (2004). What is Public Procurement? Definitional problems and implications. In K. V. Thai, A. Araujo, R. Y. Carter, G. Callender, D. Drabkin, R. Grimm, K. Jensen, R. E. Lloyd, C. McCue, & J. Telgen (Eds.) *IPPC I Proceedings - Challenges in Public Procurement: An International Perspective,* Volume 3, Boca Raton, FL, USA: PrAcademics Press.

Maciejewski, M. & Ratcliff, C. (2019) Public procurement contracts. Fact Sheets on the European Union - 2019. 2019. Available at: http://www.europarl.europa.eu/ftu/pdf/en/FTU_2.1.10.pdf, web access 6. January 2020.

Mankiw, N. G. & Taylor, M. P. (2011). *Economics*. 2. ed. Andover: South-Western, Cengage Learning, 2011.

Mardiana, S. Tjakraatmadja, J. H. & Aprianingsih, A. (2015). 'Validating the Conceptual Model for Predicting Intention to Use as Part of Information System Success Model: The Case of an Indonesian Government Agency'. *Procedia Computer Science* 72 (2015): 353–60. https://doi.org/10.1016/j.procs.2015.12.150.

Nielsen, R. (2005). Discrimination and equality in public procurement. *EU & Arbetsrätt*, 82.

OECD (2016). "Preventing Corruption in Public Procurement". Organisation for Economic Co-operation and Development. 2016. Available at: http://www.oecd.org/gov/ethics/Corruption-Public-Procurement-Brochure.pdf, web access 5. January 2020.

OECD (2009). "OECD Principles for Integrity in Public Procurement". Organisation for Economic Co-operation and Development. 2009. Available at: https://www.oecd.org/gov/ethics/48994520.pdf, web access 18. January 2020.

O'Rourke, K. H. & Williamson, J. G. (2004). Once More: When Did Globalisation Begin? *European Review of Economic History* 8, no. 1 (1 April 2004): 109–17. https://doi.org/10.1017/S1361491604001078.

O'Rourke, K. H. & Williamson, J. G. (2002). When Did Globalisation Begin? *European Review of Economic History* 6, no. 1 (1 April 2002): 23–50. https://doi.org/10.1017/S1361491602000023.

Patel, P., Satrndrakumar, D. & Khajuria, R. (2016). A Study to Identify Factors That Affect e-Procurement Implementation. *International Journal of Science Technology & Engineering (IJSTE)*, Volume 2, Issue 09, March 2016. ISSN (online): 2349-784X.

Podkolzina, E. A., Pivovarova, S. & Balsevich, A. (2011). Information Transparency in Public Procurement: How It Works in Russian Regions. *SSRN Electronic Journal*, 2011. https://doi.org/10.2139/ssrn.1998069.

Political Geography Now, (2019), "How Many Countries Are There in the World in 2020?", Political Geography Now. Available at: www.polgeonow.com/2011/04/how-many-countries-are-there-in-world.html, last update: 11. January 2019, web access 12. January 2020.

RAMBOLL/HTW Huhr (2011), Cross-border procurement above EU thresholds, final report for the European Commission, DG Internal Market and Services, Copenhagen. Available at: https://op.europa.eu/en/publication-detail/-/publication/0e081ac5-8929-458d-b078-a20676009324, published: 3. April 2013, web access 18. December 2019.

Ribeiro, M. M., Vaz, J. C. & Matheus, R. (2011). Transparency in the portals of Brazilian Federal Government: The cases of E-procurement Portal and Transparency Portal. First Global Conference on Transparency Research, Rutgers University, Newark, May 19-20, 2011.

Rickard, S. & Kono, D. (2014). Think globally, buy locally: international agreements and government procurement, *The Review of International Organizations*, Vol. 9, No 3, Springer, pp. 333-352. https://doi.org/10.1007/s11558-013-9177-x.

Saussier, S. & Tirole, J. (2015). Renforcer l'efficacité de la commande publique. *Notes du conseil d'analyse économique* 22, no. 3 (2015): 1. https://doi.org/10.3917/ncae.022.0001.

Saxena, S., & Agarwal, D. (2018). A Critical Literature Survey on Factors that Effecting E-Procurement Software. *International Journal of Advanced Research in Computer Engineering & Technology (IJARCET),* Volume 7, Issue 1, January 2018, ISSN:2278–1323.

UCLA (2016), Statistical Consulting, Available at: https://stats.idre.ucla.edu/r/dae/ordinal-logistic-regression/, last update: 2016, web access 24. February 2020.

UNDP (2019). Human Development Report 2019. Beyond income, beyond averages, beyond today: Inequalities in human development in the 21st century. LANHAM: BERNAN PRESS, 2019.

Vaidya, K., Sajeev, A. S. M. & Callender, G. (2006) 'Critical Factors That Influence E-Procurement Implementation Success in the Public Sector'. *Journal of Public Procurement* 6, no. 1/2 (March 2006): 70–99. https://doi.org/10.1108/JOPP-06-01-02-2006-B004.

Waruguru, E. (2015). 'Factors Affecting Effectiveness of E-Procurement in Business Organizations, a Survey of Safaricom Dealers in Nakuru CBD-Kenya'. International Journal of Economics, Finance and Management Sciences 3, no. 3 (2015): 303. https://doi.org/10.11648/j.ijefm.20150303.27.

The World Bank (2018). Procuring Infrastructure Public-Private Partnerships (PPPs) Report 2018, Available at:

http://pubdocs.worldbank.org/en/256451522692645967/PIP3-2018.pdf, web access 19. December 2019.

The World Bank (2019). The World Bank (Washington, District of Columbia), ed. *Doing Business 2020*. Doing Business. Washington: World Bank Group, 2019. Available at: http://documents.worldbank.org/curated/en/688761571934946384/pdf/Doing-Business-2020-Comparing-Business-Regulation-in-190-Economies.pdf, web access 21. February 2020.

WTO (2012). Revised Agreement on Government Procurement and WTO related legal instruments, Text of the GPA as amended on 30 March 2012. Available at: www.wto.org/english/docs_e/legal_e/rev-gpr-94_01_e.pdf.

WTO (2018). Trade Policy Review Body - Report to the TPRB from the Director-General on Trade-Related Developments - (Mid-October 2017 to mid-May 2018), WT/TPR/OV/W/12, 10/07/2018.

Yang, Z., Shaoha, C., Zhen, Z. & Zhou, N. (2005). Development and Validation of an Instrument to Measure User Perceived Service Quality of Information Presenting Web Portals. *Information & Management* 42, no. 4 (May 2005): 575–89. https://doi.org/10.1016/j.im.2004.03.001.

Statement of autonomous and independent work

„Ich erkläre hiermit, dass ich diese Arbeit selbstständig verfasst und keine anderen als die angegebenen Quellen benutzt habe. Alle Stellen, die wörtlich oder sinngemäss aus Quellen entnommen wurden, habe ich als solche gekennzeichnet. Mir ist bekannt, dass andernfalls der Senat gemäss Artikel 36 Absatz 1 Buchstabe o des Gesetzes vom 5. September 1996 über die Universität zum Entzug des aufgrund dieser Arbeit verliehenen Titels berechtigt ist.»

Bern, 19.04.2020   Tobias Bärtschi

Publication of the thesis

Master's or Bachelor's theses are in general made publically available at the Institute's library.

☐   Hereby I give permission to make my thesis publically available at the Library of Information Systems.

☐   I do not want to make this thesis publically available.

Should there be a confidentiality agreement, it is the student's responsibility to get the practice partner's permission for publishing the thesis. In this case, it is necessary to include an agreement signed by the practice partner.

The grading of the paper will not be influenced by whether publication is permitted or not.

Bern, 19.03.2020   Tobias Bärtschi